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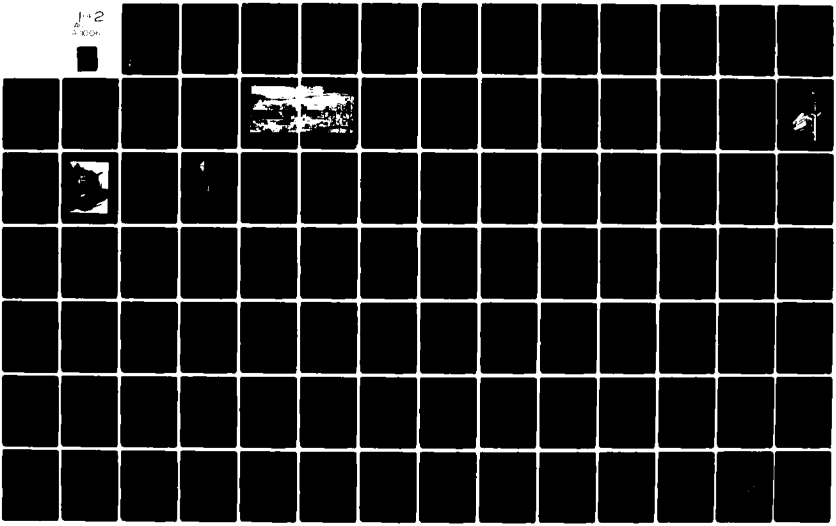

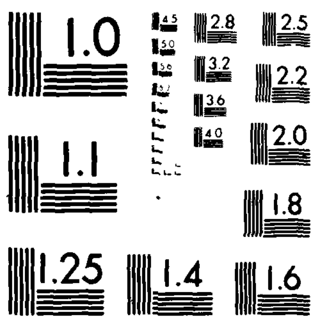

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FINAL ENVIRONMENTAL impact STATEMENT

RAIL-TO-BARGE COAL TRANSFER FACILITY
ST. LOUIS, MISSOURI

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1. REPORT NUMBER	2. GOVT ACCESSION NO. AD-A110061	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) Rail-to-Barge Coal Transfer Facility, St. Louis, Missouri Final Environmental Impact Statement		5. TYPE OF REPORT & PERIOD COVERED Final
		6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s)		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS U.S. Army Engineer District, St. Louis 210 Tucker Blvd., North St. Louis, MO 63101		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
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Environmental impact statements
Coal
Containerized shipping

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

ACBL Western, Inc. proposes to construct and operate a terminal facility with capabilities for transferring low-sulfur wester coal from unit trains to river barges. The terminal will be located on the west bank of the Mississippi River in St. Louis, Missouri just north of the southern outlet of the Chain of Rocks Canal. The facility will occupy approximately 45 acres of presently unused industrially-zoned land between the Burlington-Northern Railroad Freight yard and Hall Street. The terminal will include a rotary car dumper, coal storage —

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piles (500,000 tons) and an ancillary stacker/reclaimer, plus conveyors to carry the coal across the railroad yards and the floodwall to a barge loading facility located on the bank of the river.

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SUMMARY

RAIL-TO-BARGE COAL TRANSFER FACILITY, ST. LOUIS, MISSOURI

( ) Draft (X) Final Environmental Statement

Responsible Agency: U.S. Army Corps of Engineers
St. Louis District

1. Name of Action: (X) Administrative ( ) Legislative

2. Description of Action: The proposed action includes the construction of a 10-million ton/year coal terminal for transferring western coal from unit trains to river barges for transport to locations along the Ohio and Mississippi Rivers. The terminal will be located on the west bank of the Mississippi River in St. Louis, Missouri, just north of the southern outlet of the Chain of Rocks Canal. The facility will occupy approximately 45 acres of presently unused industrially-zoned land between the Burlington-Northern Railroad freight yard and Hall Street. The terminal will include a rotary car dumper, coal storage piles (500,000 tons) and an ancillary stacker/reclaimer, plus conveyors to carry the coal across the railroad yards and the floodwall to a barge loading facility located on the bank of the river.

3a. Beneficial Environmental Impacts:

(1) Improvements in air quality over high-sulfur coals by increasing availability of low-sulfur western coals.

(2) Mitigation of worsening energy shortage developing in the U.S.

(3) Above ground storage will insure continuity of supply.

3b. Adverse Environmental Effects:

(1) Possible effects on ambient air quality from fugitive dust.

(2) Potential for spillage into Mississippi River during barge loading.

(3) Long-term potential effects include loss of marginal wildlife habitat, noise generation, aesthetic intrusion, and interference with local traffic patterns from increased number of trains.

(4) Short-term effects during construction activities include:

(a) Local increases in turbidity of Mississippi River during dredging to deepen barge loading area and construction of sheet pile dock cells.

(b) Dust and noise from earthmoving activities in grading and leveling the site.

(c) Slight increases in traffic congestion along Hall Street.

4. Alternatives Considered:

(a) Various sites along Missouri, Mississippi, and Ohio Rivers which can be served by a one-carrier haul from western coal fields.

(b) Baghouse collection of fugitive dust versus dust supression with water sprays.

(c) Size of terminal.

(d) No action.

5. Comments Received:

U.S. Environmental Protection Agency
U.S. Department of Agriculture
Forest Service
Soil Conservation Service

U.S. Department of Housing and Urban Development
Office of the Secretary
U.S. Department of Transportation
U.S. Coast Guard
Region VII
Advisory Council on Historic Preservation
State of Missouri, Office of Administration
State of Missouri, Department of Conservation
State of Missouri, Department of Natural Resources
State of Illinois, Department of Conservation
St. Louis Regional Commerce and Growth Association

6. Draft statement to CEQ: November 7, 1975
Final statement to CEQ: 8 OCT 1976

FINAL ENVIRONMENTAL STATEMENT

RAIL-TO-BARGE COAL TRANSFER TERMINAL
ST. LOUIS, MISSOURI

TABLE OF CONTENTS

TABLE OF CONTENTS (Cont'd)

TABLE OF CONTENTS (Cont'd)

APPENDIX

Letters Received by the District Engineer on the Draft Environmental Statement

TABLES

PLATES

FIGURES

FINAL ENVIRONMENTAL STATEMENT

for

A PROPOSED RAIL-TO-BARGE COAL TRANSFER TERMINAL
HALL STREET, ST. LOUIS, MISSOURI

1. DESCRIPTION OF PROPOSED PROJECT AND FACILITIES

1.1 PURPOSE OF PROJECT

ACBL Western*, Incorporated, proposes to construct and operate a terminal facility with capabilities for transferring low-sulfur western coal from unit trains to river barges. Western coal from Wyoming and Montana will be transported by the Burlington Northern Railroad to the terminal by 100-car (nominal) unit trains. Facilities at the terminal will be used to transload the coal onto unit barge tows of the American Commercial Barge Line Company for delivery to electric power generating stations. Approximately 10 million tons of coal will be transferred annually by the facility, whose projected lifetime is 30 years. In terms of average daily traffic, this annual tonnage represents about three trains per day arriving at the terminal and about one unit tow per day departing the terminal.

Ultimate recipients of the coal to be transferred by the facility to be located at the Mississippi River in St. Louis, Missouri, will be electric power generating stations located along the inland and intracoastal waterways of the Mississippi River system downstream from St. Louis, Missouri. The destination of all coal to be handled at the terminal has not been finalized. Initial coal shipments of coal will begin in 1979, and by about 1981, approximately 4 million tons of coal per year will be shipped from the proposed terminal to a new power plant to be located on the Lower Mississippi River in Louisiana.

ACBL Western has applied to the Department of the Army for a permit to construct the dock and barge-loading components of the coal transfer terminal. This application is being processed under Section 10 of the River and Harbor Act of 1899 and Section 404 of Public Law 92-500. ACBL Western has also applied to the Missouri Clean Water Commission for certification of the proposed work in accordance with Section 401 of PL 92-500, and for an NPDES permit for discharge of runoff.

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* Affiliate of American Commercial Barge Line Company.

1.2 LOCATION

The project site is located within the city limits of St. Louis, Missouri, at river mile 184.7*. The site is about 4.5 miles north of where Routes 40, 50, and 66 cross the Mississippi River, 5 miles south of Interstate Route 270, and 0.7 miles east of Interstate 70 (see Figure 1-1). The project will use approximately 45 acres of a 70-acre project area being acquired from the Burlington Northern Railroad. The 45-acre project site is located within the area bounded on the west by Hall Street, on the north by Clarence Avenue (vacated), on the east by the yard of the Burlington Northern Railroad, and on the south by Adelaide Avenue (vacated), extended. In addition, property leased from the City of St. Louis along the Mississippi River waterfront, on both sides of the floodwall, will be used for placement of conveyors and barge-loading equipment (see Figure 1-2).

An aerial photograph of the project site and surrounding areas is shown by Plate 1. The industrial nature of the area is clearly visible in this photograph. Also visible is the Adelaide Avenue overpass under construction (now completed) over the Norfolk and Western tracks to Hall Street, the Metropolitan Sewer District lift station, the Harlem South pond adjacent to the lift station, and the location of the Harlem South outfall to the river.

Gabaret and Mosenthein Islands, both of which are in the State of Illinois, are east/northeast from the terminal site with the Mississippi River occupying the intervening area. The Illinois cities of Madison and Granite City are about 2 miles east of the project location, across the river.

1.3 DESCRIPTION OF TERMINAL

The purpose of the terminal is basically to transfer coal from unit trains to river barges for delivery to its ultimate destination. To do so requires a car dumper, means for conveying the coal either to storage piles or direct to barges, means for stacking coal in storage and subsequently reclaiming it for barge loadout, and a barge-loading system.

The general site layout plan of the Hall Street terminal, along with a transverse elevation cross-section, is shown by Figure 1-3.

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* Refers to distance north from the confluence of the Ohio and Mississippi Rivers.

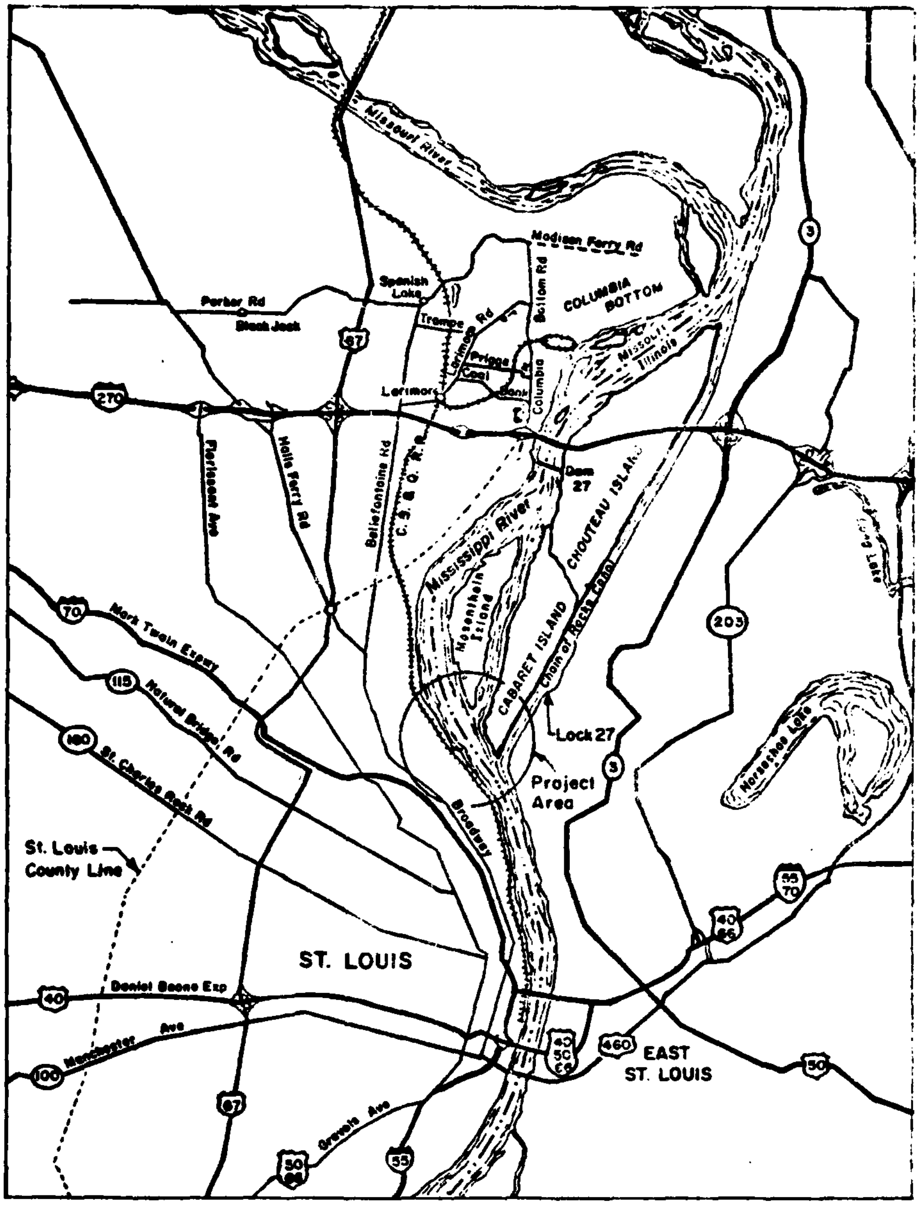

FIGURE 1-1. GEOGRAPHIC SETTING OF PROPOSED PROJECT

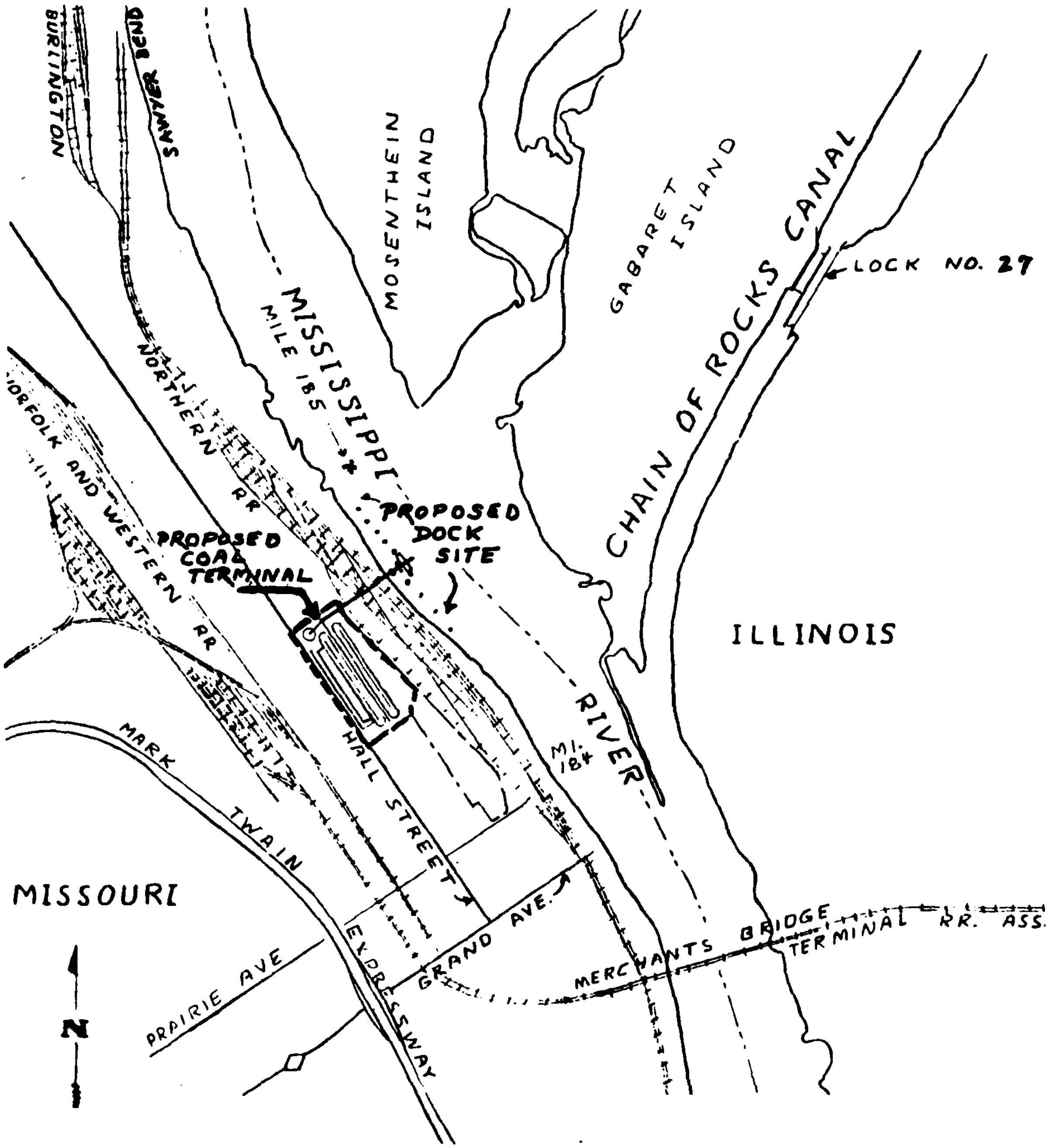

FIGURE 1-2. TERMINAL LOCATION MAP

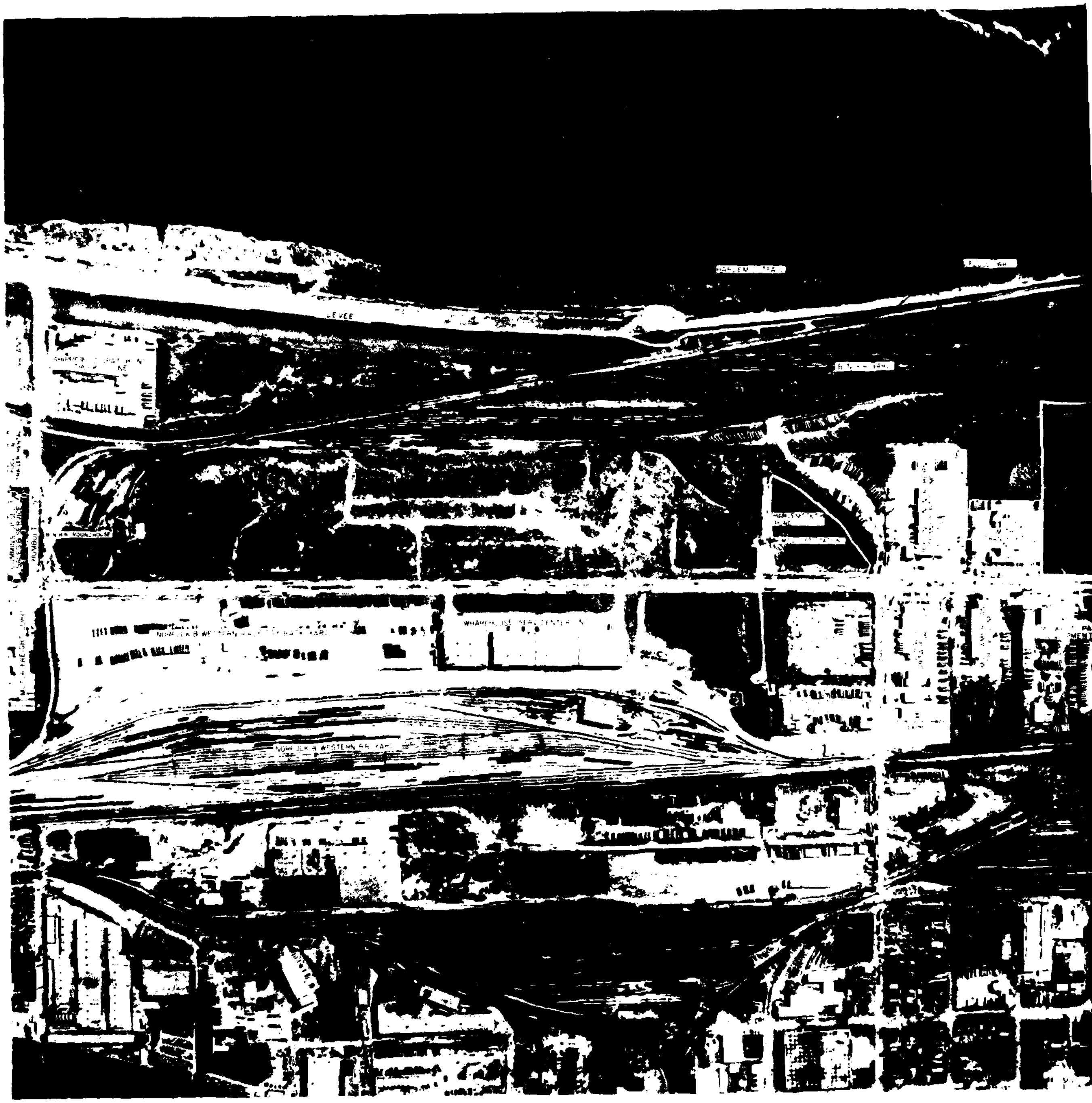

PLATE 1. AERIAL VIEW OF AREA SURROUNDING PROJECT SITE


TERMINAL SITE
ALL AMERICAN TRANSPORTS INC.
STONE CONTAINER CORP
RENTCO TRAILER LEASING CO.
ELFRINK TRUCK LINE
VACANT
VACANT
EAST PRAIRIE AVE
INTERSTATE 70

T SITE

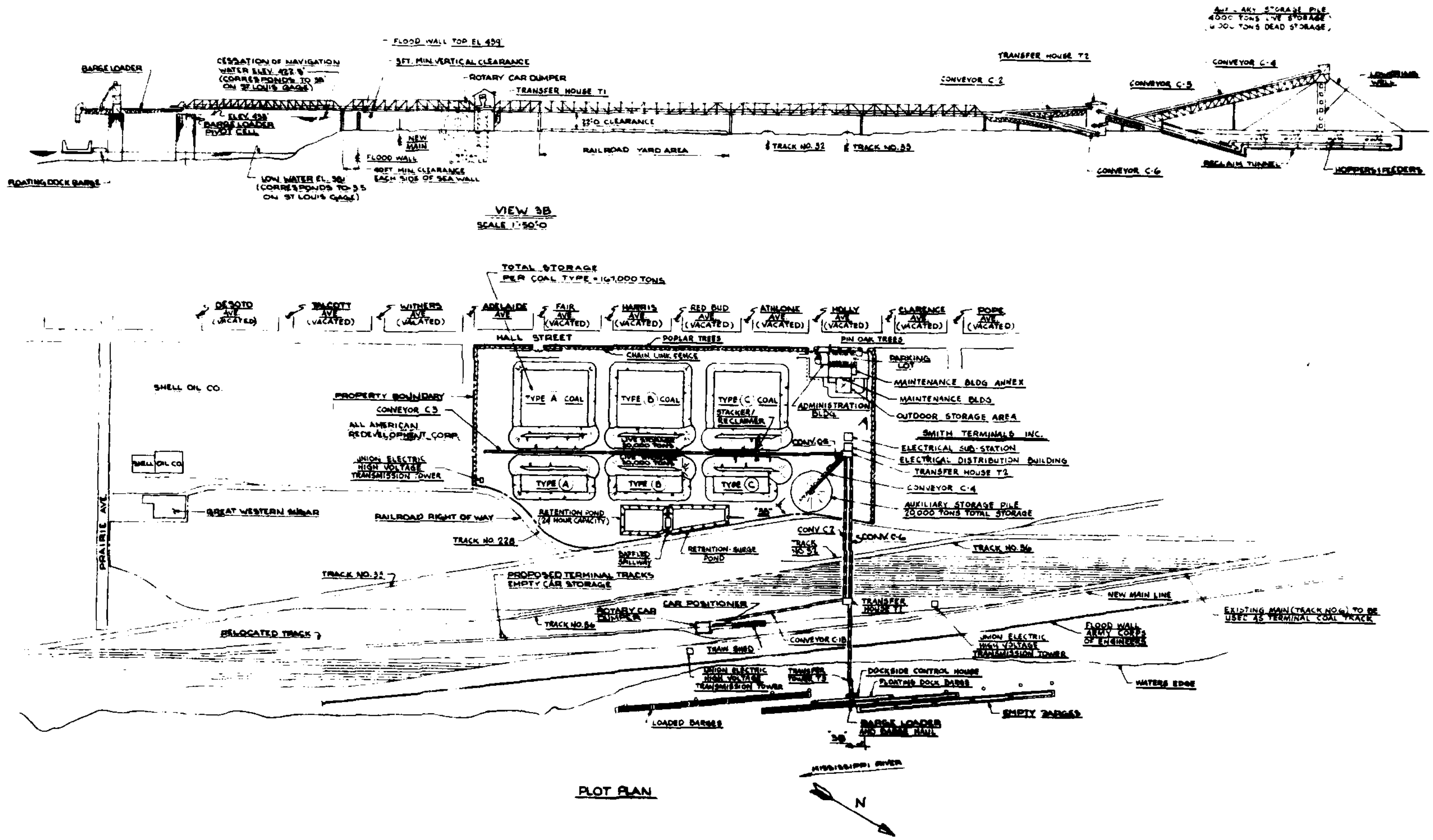

FIGURE 1-3. BASIC PLOT PLAN AND SECTION OF TERMINAL

1.3.1 COAL TERMINAL

A rotary car dumper will be used to unload the railroad cars. A dumper consists of a rotatable structure through which the car passes. When the car is properly positioned by the automatic positioner, large beams lower to automatically clamp the car firmly in place, and the whole assembly rotates, turning the car over. The mass of coal cascades out into a hopper beneath the dumper from which it is carried away by conveyor belts. Special rotary swivel couplers are used to connect the cars, and the axis of rotation of the dumper passes through the center of these couplers. Thus, it is not necessary to uncouple the cars during dumping. Dumping is a rapid and efficient operation and up to 40 cars can be unloaded per hour; only about 2-1/2 hours will be required for an entire train of 100 cars.

Sprays will be mounted on the longitudinal bars of the dumper for dust control. Sprays are placed along the front and rear of the receiving hopper underneath for additional dust suppression. The dumper represents a fairly massive piece of machinery and the entire structure requires a rigid foundation.

The dumper, car positioner, and thawing facility will be in an enclosed building (open at each end to permit trains to enter and exit) for protection of the equipment from inclement weather and to contain any dust emissions from dumping.

Cars are positioned in sequence in the correct location in the rotary dumper by a car positioner, which can be operated in either a manual or automatic mode. During unloading of trains, winches of the car positioner provide the motive power and the locomotive's diesel engines run only at idle speeds during unloading. The car positioner will be integrated with the dumper and designed and arranged to permit sequenced, automatic, and centralized control of the dumper and positioner from one control station.

A thawing facility will be erected adjacent to the positioner and rotary dumper in order to provide thawing capacity for cars in which the coal becomes frozen in transit. The thawing facility will consist of approximately five stations (five car lengths), two of which will be equipped with heating units; the second three will be "soaking stations" in which additional time will be provided for the heat to penetrate the coal. Each heating section will be equipped with electric infrared heating units of 1500-kw capacity.

In general, this facility will thaw cars with a minimum of ice on the sides and bottom of the cars at a rate of 30 cars/hour. If required, the dumping rate can be decreased to allow additional time for thawing. Since the coal will be loaded dry at the western mine, and a transit time of no more than 3 days is almost certain by unit-train handling procedures, the likelihood of using the thawing

facilities is not large. In a similar facility in a somewhat colder climate (Detroit region), freezing, except for a little crusting on the sides of the cars, has not been a problem, and thawing facilities are not used. Where winter severity is much worse (Duluth region) such facilities can be essential. Their installation in the St. Louis area is in the "insurance" category.

Conveyors will be used to convey coal along the various material flow paths connecting the rotary dumper, coal storage areas, and the barge loader. Depending on the design tonnage rates, widths of the conveyor belts will be 5 or 6 feet, the belt speed 700 to 900 feet per minute, and distances between centers of belt pulleys will be up to 1,275 feet.

Combination of factors involving schedules of trains and barge tows and different consignments of coal will require provisions for temporary storage of coal at the terminal. The coal storage yard, depicted in Figure 1-3, will consist of two parallel bays of storage. Coal can be stacked or reclaimed from either bay by rotating the boom of the rail-mounted stacker/reclaimer through 180 degrees. Maximum height of coal in these piles will be about 50 feet. Base of the piles will be at an elevation of about 427 feet.

The terminal will be arranged to handle several grades of coal (for several different customers). Three different coals (A, B, C in Figure 1-3) are assumed, with 60,000 tons "active"* and 107,000 tons "dead"* storage of each type of coal, yielding a total ground storage of 500,000 tons. As shown in Figure 1-3, the west side of the yard has provision for storage of up to 67,000 tons of dead storage and 30,000 tons of live storage of each type of coal. The east yard can contain 30,000 tons of live storage and 40,000 tons of dead storage.

To provide additional flexibility of materials handling, the terminal will include two systems for stacking and reclaiming of coal, a stacker/reclaimer, and an auxiliary tunnel system.

Most of the coal transloaded at the terminal will be handled by a stacker/reclaimer of the rotary-bucket-wheel type. The stacker/reclaimer will consist of a rail-mounted traveling gantry upon which is mounted a slewing boom that can be rotated through 180 degrees to enable the machine to stack/reclaim from the storage bay on either side of the track. The stacker/reclaimer can be operated manually or automatically

* Live storage is defined as that coal which is stacked and reclaimed by the material handling equipment unassisted. Dead storage is defined as that coal which must be dozed by mobile equipment to the live storage pile within the reach of the reclaimer for reclaiming.

in either the stacking or reclaiming mode. In the stacking mode, coal travels by conveyors from the car dumper to the stacker/reclaimer. Coal is then transferred to the stacker/reclaimer boom belt and stacked onto the coal storage pile. In the reclaiming mode, buckets on the rotating wheel of the stacker/reclaimer reclaim the coal from the pile and discharge it onto the boom belt from which it is transported by a series of conveyors to the barges. Dead storage coal must be pushed by mobile equipment to within operating distance of the machines' 103-foot boom.

When possible, the coal from an arriving train will go directly to the barges, along with the coal being retrieved from storage by the stacker/reclaimer. On the infrequent occasion when the arriving coal is different than that being reclaimed and transferred to the barges, it is stacked by a different "tunnel" system. In the tunnel system, the coal is discharged onto a conical pile (through a lowering well to prevent generation of dust by freefall). Coal is retrieved from the pile through hoppers in an underground tunnel beneath the pile, which are connected by conveyor belts to the main system. With this arrangement, the facility can be receiving one type of coal while loading barges with another.

1.3.2 BARGE LOADING SYSTEM

The dock structure will be comprised of 13 sheet pile cells varying in diameter from 20 to 32 feet (see Figure 1-4). Cells will be driven to practical refusal or bedrock depth. The bottom 5 feet will be filled with crusher-run heavy rock, to provide protection against sifting out of the granular fill material above. Cells will be filled with purchased free-draining and granular material; approximately 28,000 cubic yards of material will be required. Elevation of the top of the cells will be 433 feet MSL, which is about 2 inches above the 100-year flood. Recessed ladders, handgrabs, and mooring units will be provided as required.

As shown in the plan view of Figure 1-4, the dock face will consist of floating barges moored against four of the sheet pile cells. These cells will be equipped with guide beams, fenders, and anchoring devices so that the barges may ride up and down with changes in river levels.

A barge haul system (see Figure 1-4) consisting of a pair of variable speed, reversing, electrically driven winches mounted adjacent to the downstream end of the barge travel and connected by a haul rope will be used to position the barges. During loading, one winch is used to haul the barges under the chute of the loader and the other winch supplies a braking effect to control the slack rope and prevent the barges from being carried by the current. The hauling lines of the two winches will be equipped with two hauling rings located such that the lines will not have to be returned to their respective starting positions

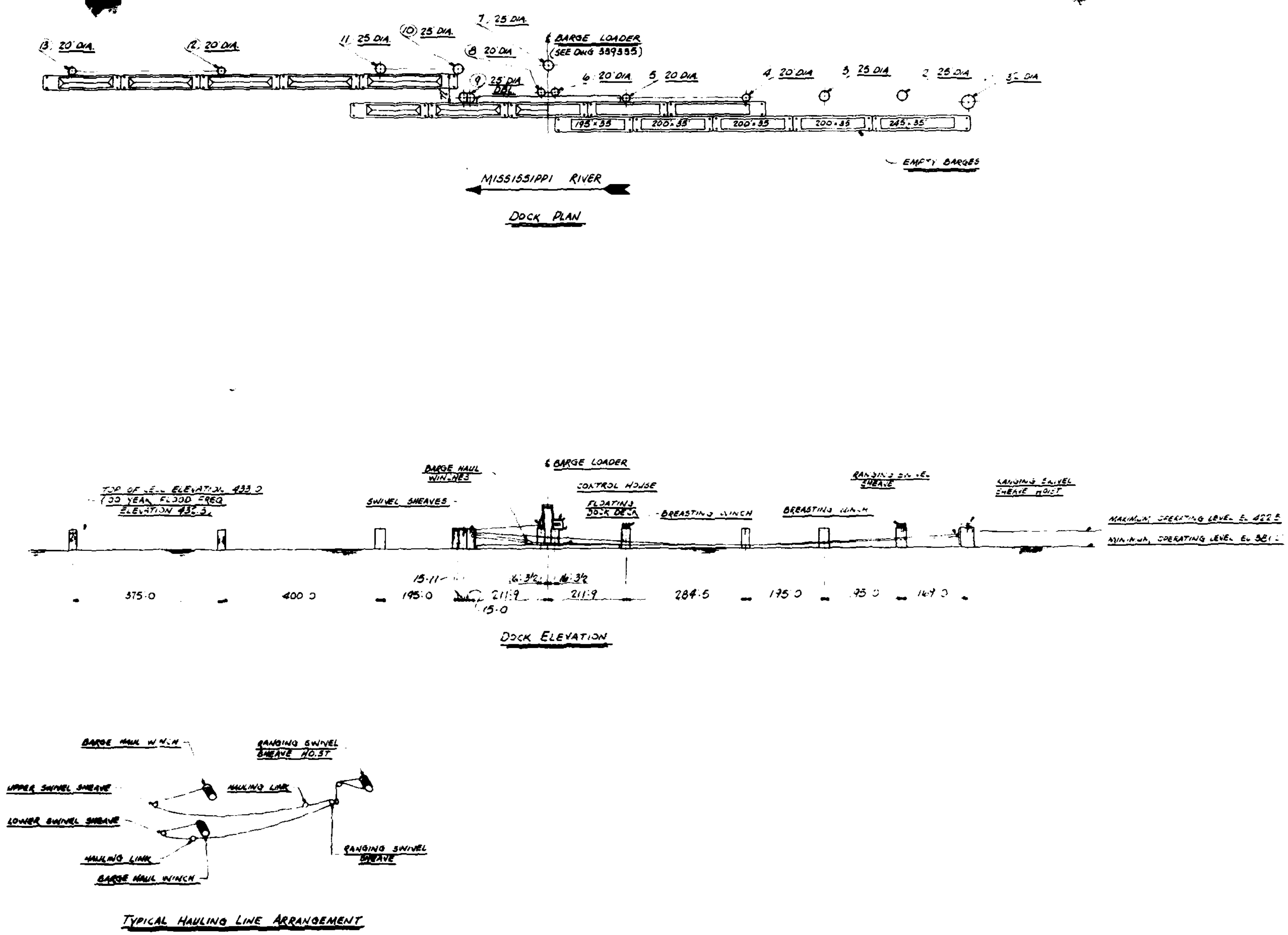

FIGURE 1-4. DOCK STRUCTURE AND BARGE HAUL ARRANGEMENT

after loading a barge string. A ranging swivel sheave arrangement will be provided at one end of the loading dock to adjust the elevation of the hauling lines for various water levels. In addition, two breasting winches will be mounted on cells in the empty barge storage area. The breasting winches will have horizontal and vertical guide rollers to accommodate changes in pool level.

The barge loader (see Figure 1-5) will consist of a structural boom which is supported at the foot by a hinge pin and at the head by hoisting lines. A heavy duty hoist on a hoist tower is used to raise and lower the loader to compensate for water level variations of up to 40 feet. A conveyor mounted on the boom will discharge coal into a bifurcated chute mounted at the boom tip. By use of the bifurcated chute, a string of five barges can be loaded continuously without interrupting the barge haul, car dumping and/or reclaim operation. The barge loader will be capable of loading coal at a maximum rate of 6000 tons per hour.

In Plate 2 is shown an aerial photograph of a similar installation on the Ohio River at Uniontown, Kentucky, operated by the Overland Coal Transportation, Inc., another subsidiary of the American Commercial Barge Line Company. In this figure is shown the stored coal, a stacker/reclaimer, and the barge loading system.

1.3.3 ADMINISTRATIVE AND MAINTENANCE BUILDINGS

A landscaped, two-story prefabricated administration building located on Hall Street at the northwest corner of the site (see Figure 1-6) will include basically a general office area, supervisory offices, lavatory facilities, a furnace room, a reception area, and a combination lunch room-conference room. The structure will be complete with a heating and air-conditioning system, plumbing, sewage, and electricity. Fuel storage will be in accordance with local codes.

A maintenance building will be provided for storing spare parts, maintenance equipment, lubricants, etc. The building will be complete with showers and toilet facilities, and a lean-to for vehicle parking. The maintenance building will be provided with a hand-operated hoist and hoisting beam for handling heavy equipment.

1.4 OPERATION OF TERMINAL

The Hall Street transfer terminal will serve as the connecting link between the rail transport of coal from Wyoming and Montana and barge transport to destinations along the Mississippi and associated river systems (see Figure 1-7). Unit coal trains operated by the Burlington Northern Railroad will transport coal from mines located in Wyoming and Montana to the proposed transfer terminal. The unit-train

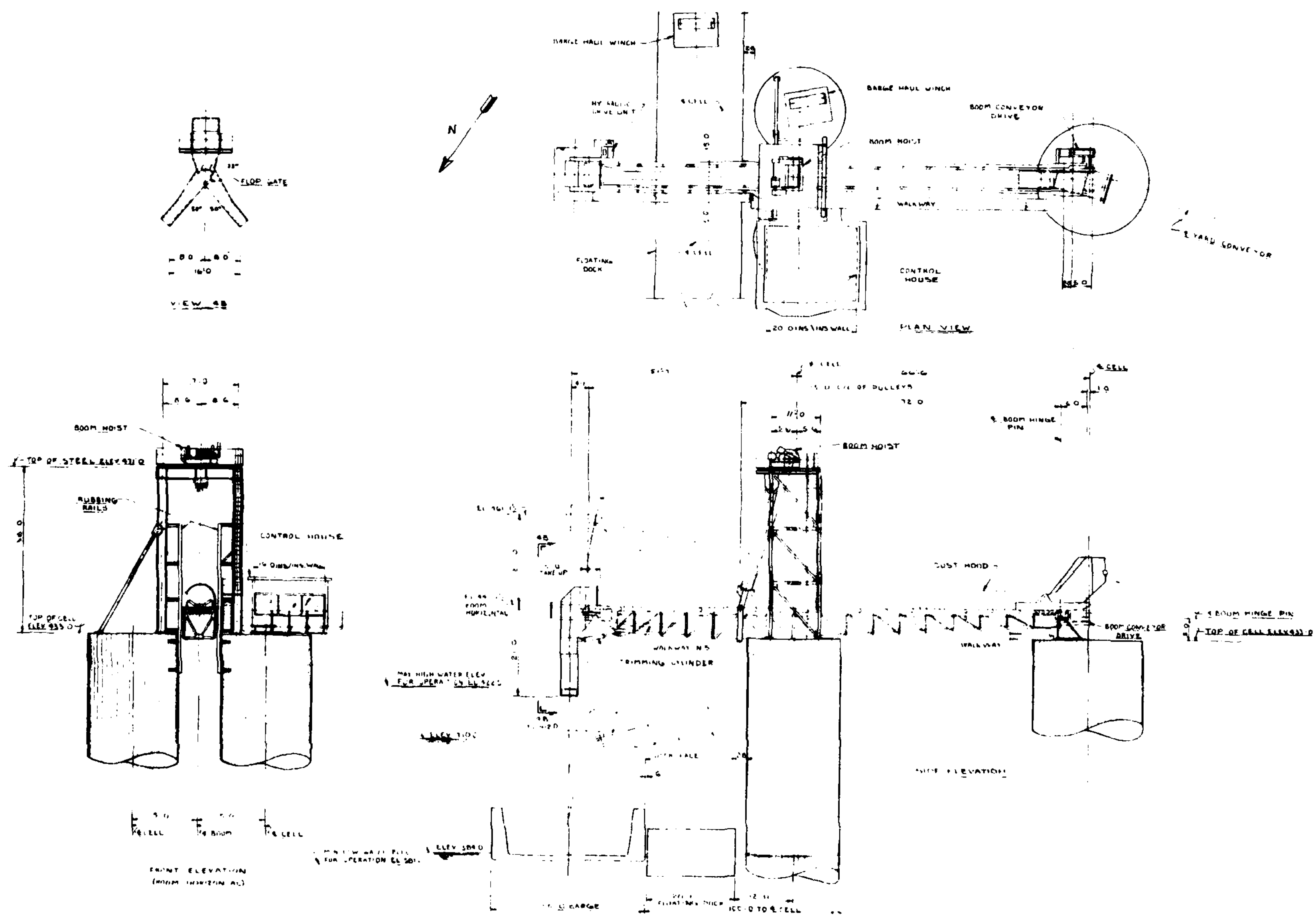

FIGURE 1-5. BARGE LOADER ARRANGEMENT

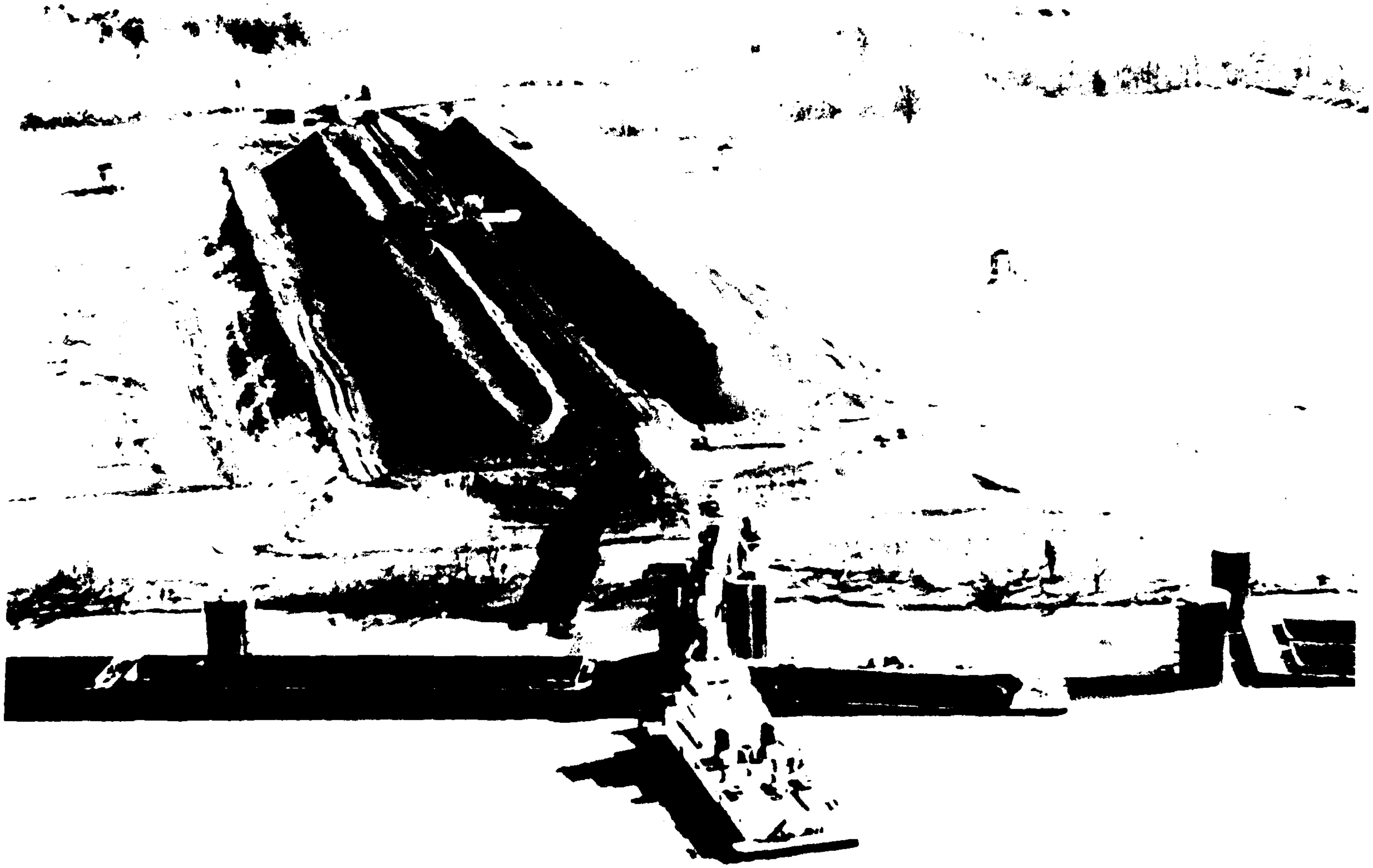

PLATE 2. MINE-TO-BARGE COAL-HANDLING FACILITY ON THE OHIO RIVER

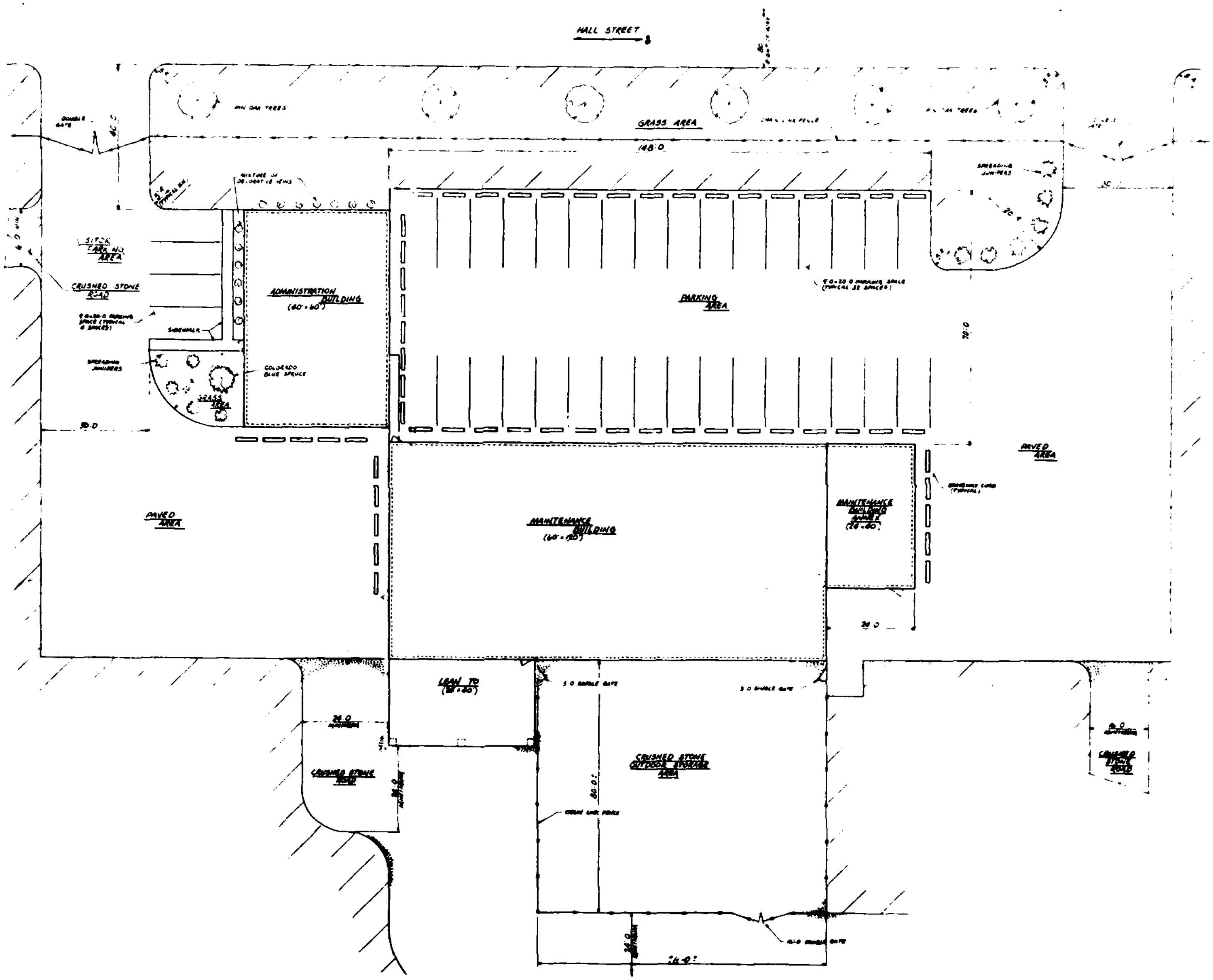

FIGURE 1-6. ADMINISTRATION AND MAINTENANCE FACILITY PLAN

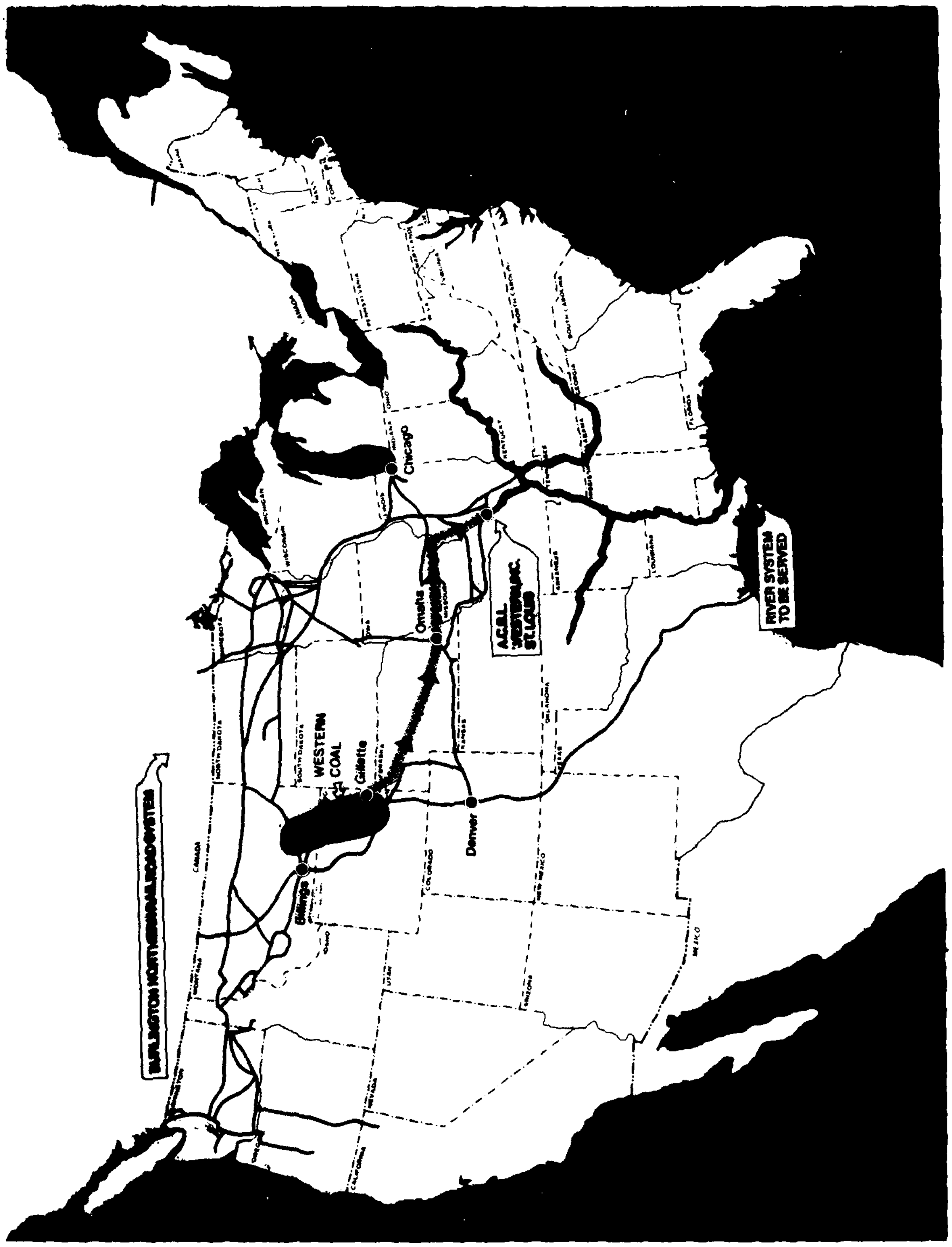

FIGURE 1-7. GENERALIZED TRANSPORTATION ROUTES

concept is based on trains more or less permanently coupled, which travel in a closed cycle as a unit, and which are dedicated to that service. Unit coal trains in direct circuit between mine and a power plant are sometimes owned by the utility, even on occasion including the motive equipment. Since in the proposed project there likely will be two or more utilities served by the terminal facility, variations of this arrangement may be necessary.

It is planned for the coal trains to operate on a route from Decker, Montana and Gillette, Wyoming via Alliance, Nebraska to Lincoln, Nebraska; thence eastward via Ottumwa, Iowa to Burlington, Iowa; thence southward to West Quincy, Missouri and Hannibal, Missouri and onto the transfer site at St. Louis. The round trip time between the coal fields and the terminal will be approximately 5 days.

Each train will nominally contain 100 cars each loaded with 100 tons of coal. Thus, 1000 trains per year will be required for an annual throughput at the terminal of 10 million tons. This is equivalent to approximately 3 trains per day arriving at the terminal, assuming 350 operating days per year.

The facility will receive coal from the Burlington Northern Railroad via an existing track in Burlington Northern's St. Louis Railroad yard that borders the project site on the east. Just north of the terminal, the trains will cross the Burlington Northern main-line grade crossing at Humboldt Avenue and then enter the terminal and move on to the terminal's load track. To avoid blocking any grade crossings during the unloading operation, after half the cars are emptied, the train is broken into two 50-car strings and the 50 empty cars are stored on the facility's storage track. Elimination of crossing blockage dictated the location of the car unloader, at the expense of somewhat lengthened conveyors.

Cars will be dumped at a rate of about 40 cars per hour. Normally, the positioning and dumping of the cars will be done automatically but manual control of dumping will also be possible. Should a second train arrive while the first is unloading, it will be detained at an outer yard, e.g., Hannibal, Missouri, or at another point north of the incoming yard.

The general movement of coal through the terminal is illustrated schematically by Figure 1-8, showing the flow of coal from the dumper direct to barges or, alternatively, to the storage piles. The tunnel system auxiliary is shown in the upper right portion of the diagram. Dust suppression points where the coal is sprayed are also indicated in the diagram.

Design of the materials handling system will permit three major handling operations to be performed. These are: (1) unload trains and stack coal only, (2) load barges only, and (3) unload trains and load barges simultaneously. The operation selected at a given time will be

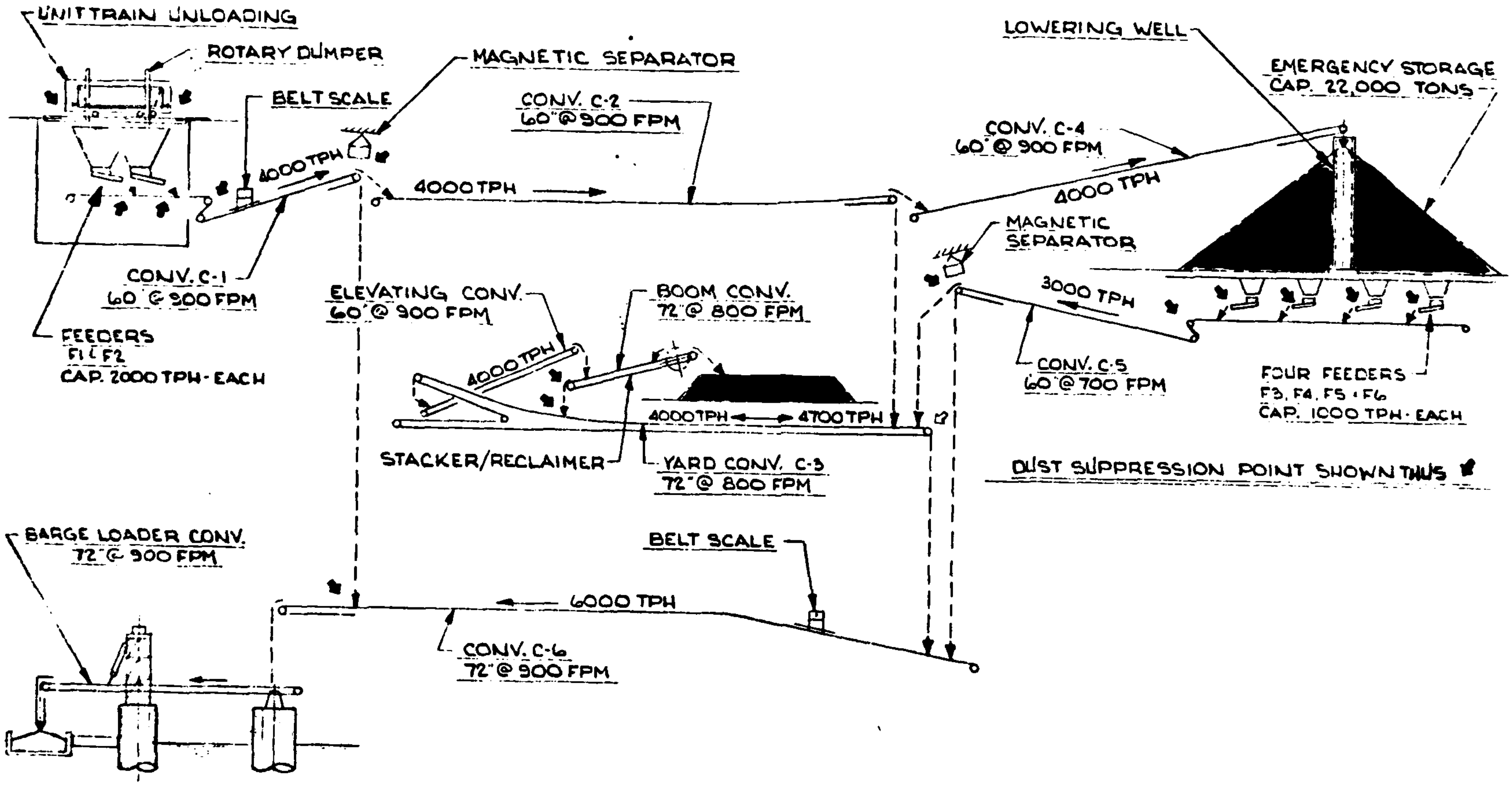

FIGURE 1-8. MATERIAL FLOW DIAGRAM.

dependent upon a combination of factors that include relationships between train and barge arrivals and the grade of coal arriving and grade of coal being shipped. The general procedure will be to handle coal as few times as possible, i.e., eliminate additional handling required for stacking and reclaiming by transferring coal directly from the car dumper to the barge loader. Also, preference will be given to using the stacker/reclaimer system because in the reclaiming mode it is more efficient than the tunnel stack/reclaim system. Stacking of coal by the tunnel system is expected to be employed only when it is necessary to unload trains and load barges simultaneously and the two coals are different. When this simultaneous operation is not required, coal would be placed in storage by the stacker/reclaimer system or routed directly to the barges.

The barge loader operator will control the reclaiming and barge loading operations from a control console located at the barge loader. Barge loading will be done under visual surveillance of the barge loader operator who will be in phone or radio contact with the various equipment operators, barge deck hands, and tow boat captain during the loading operation. The barge loader operator will also control the height of the barge loader and the speed of the barge haul through the loader to match the reclaim rate and the barge loading rate.

The barge loader will be equipped with a bifurcated loading chute equipped with a flop gate. After one barge is loaded, coal is routed to the next trailing barge without stopping the flow of coal. Because the two branches of the chute will more than span the end-to-end distance between the hoppers of the loaded and empty trailing barge, coal is prevented from falling into the river. Also, the boom of the barge loader can be luffed to minimize the distance between the ends of the chute and the top of coal in the barge being loaded. This reduces the free-air drop of coal and thus reduces the opportunity for coal dust to become airborne. Also, conveyor belts of the barge loader will be enclosed to prevent coal dust and particles from falling into the river.

Empty barges arriving at the terminal will normally be of 1.5- to 2-foot draft and made up as a 15-barge tow (3 across by 5 long). The tow will be landed at the upstream end of the dock in the empty barge area. Breasting winch lines of the barge haul system (see Figure 1-4) will be attached to the outermost string of 5 barges and the towboat untied from the tow. Each string of 5 barges is loaded as the string is hauled under the chute of the barge loader. The first string to be loaded is attached to the upstream hauling ring. The haul winch hauls in the rope tied to the string and the barges pass under the coal loading chute at a speed which the barge loader operator can vary to match the coal loading rate. Lines from a restraining winch are tied to the string and serve as brakes to control the slack rope and prevent the barges from being carried down current. After loading, the first string of 5 barges is moved to the downstream loaded barge storage area by the attending towboat. The operation is essentially repeated for each of the remaining

two strings of barges. Breasting force is applied to the third string while it is being loaded. After all the barges have been loaded, necessary rigging is made up between the barges to configure them as a tow. The towboat moves the upstream end of the tow away from the dock, is tied to the upstream end of the tow, and the tow can depart from the terminal. Draft of a loaded barge is about 9-11 feet.

A loaded 15-barge tow contains about 24,000 tons of coal. An annual 10 million tons through the terminal then averages out to 1.2 tows/day being loaded at the terminal, assuming a 350-day operating year.

All navigation at the terminal will cease when river level elevation is about 422.5 feet which is 10.3 feet below the 100-year flood level and 16.5 feet below the top of the City of St. Louis' flood wall.

1.5 TERMINAL CONSTRUCTION

Major construction activities for the land portion of the terminal will be those required to perform the cut, fill, and grading operations to establish the necessary grades and elevations; excavation for and installation of foundations for heavy equipment (e.g., rotary car dumper) and buildings; trenching for installation of utilities, laying of railroad track, and steel work for erection of conveyors, stacker/reclaimer, transfer towers, dumper, and buildings.

To establish the land grades and ground elevations, approximately 63,000 cubic yards of soil-type surface material will be excavated from the terminal area. About 24,000 yards of this material will be used elsewhere on-site to fill to the desired grade, and the balance will be used for the railroad track subgrade. The hoppers underneath the car dumper will extend down into bedrock, necessitating removal of about 2,000 cubic yards of rock, so that some blasting will be required.

The dumper is located to the east of the coal storage area, on the eastern side of the Burlington Northern freight yard. (see Figure 1-3). In order to protect the flood wall and the railroad from any possible damaging effects the blasting will be performed inside an internally braced cofferdam. The bracing will be only 8 feet above the top of rock, which will necessitate that the blasting be done in very small shots to protect the bracing. Rock will be removed by line drilling around the perimeter, and blasting will begin at the center and work out. Light shots will be used to protect the bracing and to prevent overbreak beyond the sheet piling line, which would let water in under the piling. No damage will occur to the flood wall (approximately 140 feet distant) or to the railroad (approximately 60 feet distant).

Evaluation of the planned blasting and the soil between the car dumper foundation and the flood wall indicates that blasting will have a negligible effect on the flood wall (STS Engineers, 1975). To confirm that no damage to the flood wall results from the nearby construction activities, the floodwall will be monitored during construction by procedures approved by the St. Louis District.

Since the coal storage area is in substantial part underlain by filled ground, which is itself underlain by poorly consolidated clays and silts, (Figure 2-2) some settlement is anticipated as the soil loading is increased by the piling of coal on it. In order to control the rate of settlement and to insure maximum stability, the maximum initial height of coal will be held to 25 feet for both the "live" (active) and "dead" storage piles. Piles will be built up simultaneously on each side of the stacker/reclaimer track. The height of coal will be gradually increased; the rate at which this is accomplished will be dependent on the amount of settling observed as manifested by settling of the stacker/reclaimer rail track.

Settlement computations (STS Engineers, 1975), indicate no effect on existing water and sewer lines located along the east side of Hall Street. The effect of the coal piles on the ground and ground surface beyond 30 feet from the piles will be negligible. Distance to Hall Street from the 28-foot high ("dead" storage) coal pile is 75 feet, and 310 feet from the 50-foot high live storage coal pile. In the other direction, the nearest railroad tracks are about 180 feet from the low dead storage piles and 290 feet from the 50-foot high live storage pile. Minimum distance from the coal piles to the north and south property boundary fences will be approximately 280 feet. Thus, it is evident that the coal piles will have no effect on existing adjacent structures or railroad tracks. All major site buildings, exceeding 200 square feet in area, and within 300 feet of the coal piles will be founded on rock bearing piles, and will not be affected by settlement.

Chief construction activities in the barge loading area of the terminal will be those associated with removal of the random-sized rock presently lining the bottom in the barge docking area, and with the driving of the sheet piling for the cellular dock cells. The volume of random rock which may be necessary to remove is indeterminate but is estimated to be about 7,500 cubic yards or less. It will be removed by clamshell and grapple, and placed along the riverbank as specified by the St. Louis District. The random rock is lying on shelf rock (whose elevation is approximately 371-372 feet in this area) and its removal will provide a 9-foot depth at all but the lowest river levels (Zero on the St. Louis gage is at approximately 380 feet.)

Most of the heavy process and materials handling equipment for the terminal will arrive on site by barge or rail, minimizing highway transport. The rock and gravel for filling the dock cells will also be brought to the site by barge.

1.6 ENVIRONMENTAL PROTECTION MEASURES

The design of the terminal has incorporated measures for protection of the surrounding environment. The substance of these measures as they relate to the construction and operation of the terminal are described in this section. These measures are referred under appropriate topics in subsequent sections where they are presented within a mitigative, preventive, or control measure to abate or eliminate probable impacts of the proposed project.

1.6.1 AIR QUALITY

Construction of the terminal will require the excavation and transport of several thousand cubic yards of unconsolidated surface soil on site. During dry weather, haul roads will be watered to prevent or reduce the amount of dust that becomes airborne. Lifts of soil being compacted will be moistened in compliance with good construction practices, as necessary.

Present design of the terminal incorporates several methods for minimizing or eliminating airborne coal dusts from operations:

(1) Spraying coal at key points along the material flow paths with water containing a wetting agent that reduces surface tension of water. The wetting agent also acts to prevent or reduce the amount of dust becoming airborne from coal storage piles. The spray water lines will be heat-traced to prevent freezing during use.

(2) Covering all conveyors with dust hoods except the extensible yardbelt serving the stacker/reclaimer, which will be equipped with windguards.

(3) Keeping distance of free-air drop of coal to a minimum because of the capability to raise and lower the booms of the stacker/reclaimer and the barge loader.

(4) Enclosing transfer towers to prevent exposure of coal to wind.

(5) Enclosing rotary car dumper and positioner and associated feeder hoppers in an approximately 315-foot-long building.

(6) Using a lowering tower to contain the coal during its drop from the fixed boom stacker to the conical coal pile of the auxiliary tunnel stack/reclaim system.

(7) Filtering air from the tunnel under the auxiliary tunnel stack/reclaim system before discharge to atmosphere.

Points where water spray can be applied as coal moves from the car dumper to storage and barges are shown in Figure 1-8. As shown in this figure, locations for spraying the inbound coal include the following:

- Car dumper barrel; sprays along length of car (approximately 60 percent of water is applied here and at the receiving hopper
- Top of dumper receiving hopper, front and rear
- Discharge feeder to belt conveyor
- Skirt boards along belt conveyor
- Belt-to-belt transfer points.

Similar procedures will be followed during reclaiming of coal, as indicated by the arrows in Figure 1-8.

Although design is not yet finalized, current plans call for a total of 120 sprays on the incoming coal, each rated at 1.2 gpm per nozzle. A maximum of 2.5 gal/ton of spray will be distributed among all the points of application. With the problem of controlling the shock load of an entire carload dumping absent, a lesser application is required for reclaiming coal from storage, and a maximum of 1 gal/ton has been specified. The spraying system will incorporate a wetting agent in the ratio of 1:3000 or 1:3500 water; the wetting agent markedly enhances the wetting of the coal and the coalesence and agglomeration of the fine dust particles. Water for the spray will be obtained from City of St. Louis Water Department. Wetting agent is added to the spray water by an automatic proportioning pump. Sprays are automatically energized only when material is present to be sprayed.

Dust control systems of this type are designed to control the dust at the application point areas. However, in addition, the carry-over dust control effect resulting from treatment of the material at the application points will extend the dust control to subsequent material handling operations such as conveyor transfer and discharge points.

The system to be installed at the Hall Street coal transfer terminal will be designed by one of the U.S. companies specializing in

dust control. Such systems, when installed, maintained, and operated according to specifications, are guaranteed to meet Federal, State and local particulate air pollution requirements at the application points.

New regulations have recently been issued by the U.S. Environmental Protection Agency, promulgating standards of performance for coal preparation plants, including barge loading facilities (U.S. EPA, 1976). This regulation sets an upper limit of 20 percent opacity for discharges into the atmosphere from any coal conveying equipment, storage system, or transfer and loading system. Open storage piles of coal are specifically exempted from provisions of the regulations.

Elimination of the air pollution problem does not, however, create a water pollution problem in its place. It should be noted that 2.5 gallons of water per ton of coal represents just over 1 percent by weight of the coal. This is far below the quantity at which runoff becomes a consideration; the coal will visually appear to be no wetter than it was prior to the spray application. The wetting agent will remain on the surface of the coal, and will be shipped out with it. Thus, no water pollution problem results.

1.6.2 WATER QUALITY

Surface runoff from the project site as it now exists drains generally to one or more of three shallow elongated topographic basins, presumably borrow pits from previous railroad yard construction. One of these is located at the east edge of the project site, and two are in the railroad yard, one in the area in which the car dumper is to be located. Development of the grade of the terminal and the subgrade of the unloading and storage tracks will eliminate these low areas.

The existing soil in the main coal storage yard will be graded, and sloped from west to east from Hall Street. A perimeter drainage ditch will encircle the coal storage area. Two east-west drainage ditches, dividing the main storage yard into thirds, will be cut at grade into the soil so that any storm water which percolates through the coal piles will have a more direct route to the main perimeter ditch.

A permanent retention pond will be constructed to collect runoff from the site and to retain any coal washed from the storage piles. The perimeter ditch will direct the water to the retention pond, located to the east of the coal storage area (see Figure 1-3). This pond will permit the settling out of any heavy coal particles that may be suspended in the runoff and will be designed with a baffled weir for retention of floating solids. Supernatant from this pond will gravity flow to the adjacent retention surge pond. The surge pond will be equipped with a drainage outlet pipe located in its bottom for controlling flow to the natural drainage ditch paralleling the existing railroad track which forms the eastern boundary of the property. Water collected by this

ditch will flow northward to the existing Harlem South Pond, for discharge into the Mississippi River. via the Harlem South Pond outfall (see Plate 1).

The pond will have a capacity of 115,000 cubic feet and a depth of approximately 4 feet. The retention pond was sized to collect the runoff from a 3.5-inch 24-hour rainfall, assuming an average runoff coefficient of 0.25. Maximum recent 24-hour rainfall recorded at St. Louis was 3.29 inches in June, 1969 (see Table 2-8); the average of the monthly maximum rainfalls recorded over the 15-year period of record was 2.58 inches. The retention-surge pond will have a capacity of 65,000 cubic feet and a depth of approximately 2-3/4 feet.

Retention time for a given parcel of water from the design storm would be some substantial fraction of 24 hours, depending on the fullness of the retention pond prior to the storm and on the rate of replacement of its contents by the precipitation.

Coal fines settled out will gradually build up on the bottom of the retention pond, and it will infrequently have to be dug out to restore design catchment capacity. Disposal will be achieved by returning the reclaimed coal to the coal circuit if the quality is acceptable; otherwise it will be disposed of to a landfill.

All storm runoff provisions will be in compliance with standards established by the St. Louis Metropolitan Sewer District.

1.7 TERMINAL COST, CONSTRUCTION SCHEDULE, AND STAFFING

Cost of the proposed terminal is estimated at $15 million based on June 1, 1975 prices. This amount includes capital equipment, materials, contract services, and labor.

It is estimated that construction will start during the summer of 1976 which will provide lead time for necessary start-up and check-out procedures, unanticipated delays, and acquiring sufficient coal inventory in storage. Estimated construction time is about 34 months. The terminal is scheduled to begin delivering coal early in 1979 to a new power plant to be located on the Lower Mississippi River, near New Roads, Louisiana.

Approximately 40 people will be required to operate the terminal. This number includes supervisors, equipment operators, mechanics, clerks, electricians, and general laborers.

2. ENVIRONMENTAL SETTING WITHOUT THE PROJECT

2.1 PHYSICAL ENVIRONMENT

2.1.1 PHYSIOGRAPHY

The 45-acre project site is located in the Central Lowlands physiographic province (Fenneman, 1938). Surface features in the general St. Louis area are largely a result of the actions of Pleistocene glaciers and denudation and/or deposition by waters of the Mississippi River system. Loess deposits are not uncommon, e.g., bluffs along the Missouri River in St. Louis County (Lutzen and Rockaway, 1971).

St. Louis is at the boundary between glaciated regions to the north and nonglaciated regions to the south. North to south, the terrain changes regionally from one that is characteristically flat to a gently rolling topography of dissected till plains to one that exhibits increasing relief and ruggedness characteristic of Ozark Plateau topography.

The north-south valley of the Mississippi River is the dominant landform in the general vicinity of the project, i.e., a circular area within a 10-mile radius from the project site. Over a 15-mile distance westward, land elevations increase from about 400 feet at the Mississippi River to some 600 feet in parts of metropolitan St. Louis and then decrease to 440 feet at the floodplain of the Missouri River. The confluence of the Missouri and the Mississippi Rivers is at river mile 195 which is about 10 miles north of the project site. (see Figure 1-1.)

The main stem of the Mississippi River, between river miles 189 and 185, separates the immediate locale of the project site from Gabaret and Mosenthein Islands. Gabaret Island is immediately east of Mosenthein Island with a distributary channel or chute of the river separating the two islands, which rejoins the main stem at river mile 185. Between river miles 185 and 184, the Mississippi River separates the project area from Gabaret Island which is bordered on the east by the navigable Chain of Rocks Canal. (see Figure 1-2.) The southern junction of the 10-mile long canal and the river is at river mile 184. Maximum elevations of Mosenthein and Gabaret Islands are about 415 feet. The expanse of the Mississippi River Illinois floodplain in the vicinity of the project is much more extensive than in Missouri; distances across the Illinois floodplain are as much as 7 or 8 miles.

The 45-acre project site is between river miles 185 and 184, and is approximately 700 feet west of the Mississippi River. The site is in a former floodplain of the river, protected by levees and the City of St. Louis' floodwall. This former floodplain narrows in width

proceeding southward, from about one mile* at river mile 189, to 0.3 mile at river mile 180 (Eads Bridge). At the project site, the former floodplain is about 0.6 mile wide.

Topographically, the former floodplain in the vicinity of the project site is characterized by broad low-relief ridges, hummocks, and elongated topographic lows and closed depressions. Elevations increase from 400 feet at the river shoreline to 440 or 450 feet at the base of the low bluffs along Broadway Avenue in St. Louis.

A detailed topographic survey of the 45-acre project site conducted in April, 1975 (STS Engineers, 1976) yielded site elevations ranging from about 418 feet to 428 feet. The higher elevations are characterized by low-relief topographic highs that trend roughly parallel to Hall Street and the shoreline of the river. Lower elevations are often elongated topographic depressions at least some of which may be borrow pits. The topographic features between the project site and the river are quite similar to those at the site except that elevations are lower toward the river. Also, the effects of railroad track subgrades present between the project site and the river are manifest as low-relief north-south ridges with nominal elevations of 420 feet.

2.1.2 GEOLOGY

2.1.2.1. Stratigraphy

A generalized stratigraphic column for counties of St. Charles, St. Louis, and Jefferson, Missouri is shown in Table 2-1. Represented in the column are unconsolidated deposits of Quaternary Age and bedrock of Paleozoic and Precambrian Age. Unconsolidated fluvial and probably glacio-fluvial Quaternary deposits occur in stream valleys and terraces. Quaternary loess and/or glacial till is sometimes present at higher elevations. Pennsylvanian rocks underlie Quaternary deposits and are typically cyclic deposits of shales, siltstones, and sandstones. Carbonates predominate the Mississippian section. Separating the Mississippian and Precambrian rocks is a section of older Paleozoic clastics and carbonates.

East of the project site in the Illinois floodplain (American Bottoms) of the Mississippi River, Schict's (1965) isopach map indicates alluvial thicknesses to be 20 to 40 feet near the river and increasing up to 120 feet eastward from the river. Elevations at the top of bedrock range between 280 and 340 feet.

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* Distances between the west shore of the Mississippi River and a line marking a relatively sharp increase in elevations at Broadway Avenue as measured on the USGS 7-1/2 minute Granite City quadrangle.

TABLE 2-1. GENERALIZED STRATIGRAPHIC COLUMN FOR ST. CHARLES, ST. LOUIS, AND JEFFERSON COUNTIES, MISSOURI [From Miller, et al. (1974)]

System	Series	Group	Formation	Aquifer group	Thickness (feet)	Dominant lithology	Water-bearing character
Quaternary	Holocene		Alluvium 1/		0-150	Sand, gravel, silt, and clay.	Some wells yield more than 2,000 gpm.
	Pleistocene		Loess		0-110	Silt	
			Glacial till		0-55	Pebbly clay and silt.	Essentially not water yielding
Pennsylvanian	Missourian	Pleasanton	Undifferentiated		0-75	Shales, siltstones, "dirty" sandstones, coal beds and thin limestone beds	Generally yields very small quantities of water to wells. Yields range from 0-10 gpm.
		Marmaton	Undifferentiated		0-90		
	Desmoinesian	Cherokee	Undifferentiated		0-200		
	Atokan		Undifferentiated				
Mississippian	Meramecian		Ste. Genevieve Formation		0-160	Argillaceous to arenaceous limestone.	
			St. Louis Limestone		0-16?		
			Salem Formation		0-160		
			Warsaw Formation		0-1??		
	Osagean		Burlington-Keokuk Limestone	1	0-240	Cherty limestone	
			Fern Glen Formation		0-105	Red limestone and shale.	Yields small to moderate quantities of water to wells. Yields range from 5 to 50 gpm. Higher yields are reported for this interval locally.
	Kinderhookian	Chouteau	Undifferentiated		0-122	Limestone, dolomitic limestone, shale, and siltstone.	
Devonian	Upper	Sulphur Springs	Bushberg Sandstone		0-60	Limestone and sandstone.	
			Glen Park Limestone				
			Grassy Creek Shale		5-50	Fissile, carbonaceous shale.	
Silurian			Undifferentiated		0-200	Cherty limestone.	
Ordovician	Cincinnatian		Maquoketa Shale		0-163	Silty, calcareous or dolomitic shale.	Probably constitutes a confining influence on water movement.
			Cape Limestone		0-5	Argillaceous limestone.	
	Champlainian		Kimmswick Formation		0-145	Massive limestone	
			Decorah Formation		0-50	Shale with interbedded limestone	Yields small to moderate quantities of water to wells. Yields range from 3 to 50 gpm. Decorah Formation probably acts as a confining bed locally.
			Plattin Formation	2	0-240	Finely crystalline limestone.	
			Rock Levee Formation		0-93	Dolomite and limestone, some shale.	
			Joachim Dolomite		0-135	Primarily argillaceous dolomite.	
			St. Peter Sandstone		0-160	Silty sandstone, cherty limestone grading upward into quartzose sandstone.	Yields moderate quantities of water to wells. Yields range from 10-140 gpm.
			Everton Formation	3	0-130		
	Canadian		Powell Dolomite		0-15?	Sandy and cherty dolomites and sandstone.	Yields small to large quantities of water to wells. Yields range from 10 to 300 gpm. Upper part of aquifer group yields only small amounts of water to wells.
			Cotter Dolomite		0-32?		
			Jefferson City Dolomite	4	0-225		
			Roubidoux Formation		0-177		
			Gasconade Dolomite Gunter Sandstone Member		0-280		
Cambrian	Upper		Eminence Dolomite		0-172	Cherty dolomites, siltstones, sandstone, and shale.	Yields moderate to large quantities of water to wells. Yields range from 10 to 400 gpm.
			Potosi Dolomite		0-325		
		Elvins	Derby-Doerun Dolomite	5	0-165		
			Davis Formation		0-150		
			Bonneterre Formation		245-385		
			Lamotte Sandstone		235+		
Precambrian						Igneous and metamorphic rocks.	Does not yield water to wells in this area.

1/ Basal part may be of Pleistocene age.

NOTE: Stratigraphic nomenclature may not necessarily be that of the U.S. Geological Survey.

proceeding southward, from about one mile* at river mile 189, to 0.3 mile at river mile 180 (Eads Bridge). At the project site, the former floodplain is about 0.6 mile wide.

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	Pleistocene		Loess		0-110	Silt	
			Glacial till		0-55	Pebbly clay and silt.	Essentially not water yielding
Pennsylvanian	Missourian	Pleasanton	Undifferentiated	1	0-75	Shales, siltstones, "dirty" sandstones, coal beds and thin limestone beds.	Generally yields very small quantities of water to wells. Yields range from 0-10 gpm.
		Marmaton	Undifferentiated		0-90		
	Desmoinesian	Cherokee	Undifferentiated		0-200		
	Atokan		Undifferentiated				
Mississippian	Meramecian		Ste. Genevieve Formation		0-160	Argillaceous to arenaceous limestone.	
			St. Louis Limestone		0-185		
			Salem Formation		0-180		
			Warsaw Formation		0-110		
	Osagean		Burlington-Keokuk Limestone		0-240	Cherty limestone	
			Fern Glen Formation		0-105	Red limestone and shale.	Yields small to moderate quantities of water to wells. Yields range from 5 to 50 gpm. Higher yields are reported for this interval locally.
	Kinderhookian	Chouteau	Undifferentiated		0-122	Limestone, dolomitic limestone, shale, and siltstone.	
Devonian	Upper	Sulphur Springs	Bushberg Sandstone		0-60	Limestone and sandstone.	
			Glen Park Limestone				
			Grassy Creek Shale		0-50	Fissile, carbonaceous shale.	
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Ordovician	Cincinnatian		Maquoketa Shale		0-163	Silty, calcareous or dolomitic shale.	Probably constitutes a confining influence on water movement.
			Cape Limestone		0-5	Argillaceous limestone.	
	Champlainian		Kimmswick Formation	2	0-145	Massive limestone	Yields small to moderate quantities of water to wells. Yields range from 3 to 30 gpm. Decorah Formation probably acts as a confining bed locally.
			Decorah Formation		0-50	Shale with interbedded limestone.	
			Plattin Formation		0-260	Finely crystalline limestone.	
			Rock Levee Formation		0-93	Dolomite and limestone, some shale.	
			Joachim Dolomite		0-135	Primarily argillaceous dolomite.	
			St. Peter Sandstone	3	0-160	Silty sandstone, cherty limestone grading upward into quartzose sandstone.	Yields moderate quantities of water to wells. Yields range from 10-140 gpm.
			Everton Formation		0-130		
	Canadian		Powell Dolomite	4	0-155	Sandy and cherty dolomites and sandstone.	Yields small to large quantities of water to wells. Yields range from 10 to 300 gpm. Upper part of aquifer group yields only small amounts of water to wells.
			Cotter Dolomite		0-320		
			Jefferson City Dolomite		0-225		
			Roubidoux Formation		0-177		
			Gasconade Dolomite Gunter Sandstone Member		0-280		
Cambrian	Upper		Eminence Dolomite	5	0-172	Cherty dolomites, siltstones, sandstone, and shale.	Yields moderate to large quantities of water to wells. Yields range from 10 to 400 gpm.
			Potosi Dolomite		0-325		
		Elvins	Derby-Doerun Dolomite		0-165		
			Davis Formation		0-150		
			Bonneterre Formation		245-385		
			Lamotte Sandstone		235+		
Precambrian						Igneous and metamorphic rocks.	Does not yield water to wells in this area.

1/ Basal part may be of Pleistocene age.

NOTE: Stratigraphic nomenclature may not necessarily be that of the U.S. Geological Survey.

Alluvial thicknesses in floodplains of streams and rivers in the counties of St. Charles, St. Louis, and Jefferson, Missouri are shown in Figure 2-1. Data on alluvial thicknesses in the floodplain of the Mississippi River at St. Louis are not abundant. Just north of St. Louis at Columbia Bottom, a floodplain at the confluence of the Missouri and Mississippi Rivers, three holes penetrated thicknesses of 46, 72, and 82 feet before striking bedrock (Battelle, 1974). Corresponding bedrock elevations are 367, 350, and 342 feet. Driller's logs of these holes are given in Table 2-2; locations of the holes are shown in Figure 2-1.

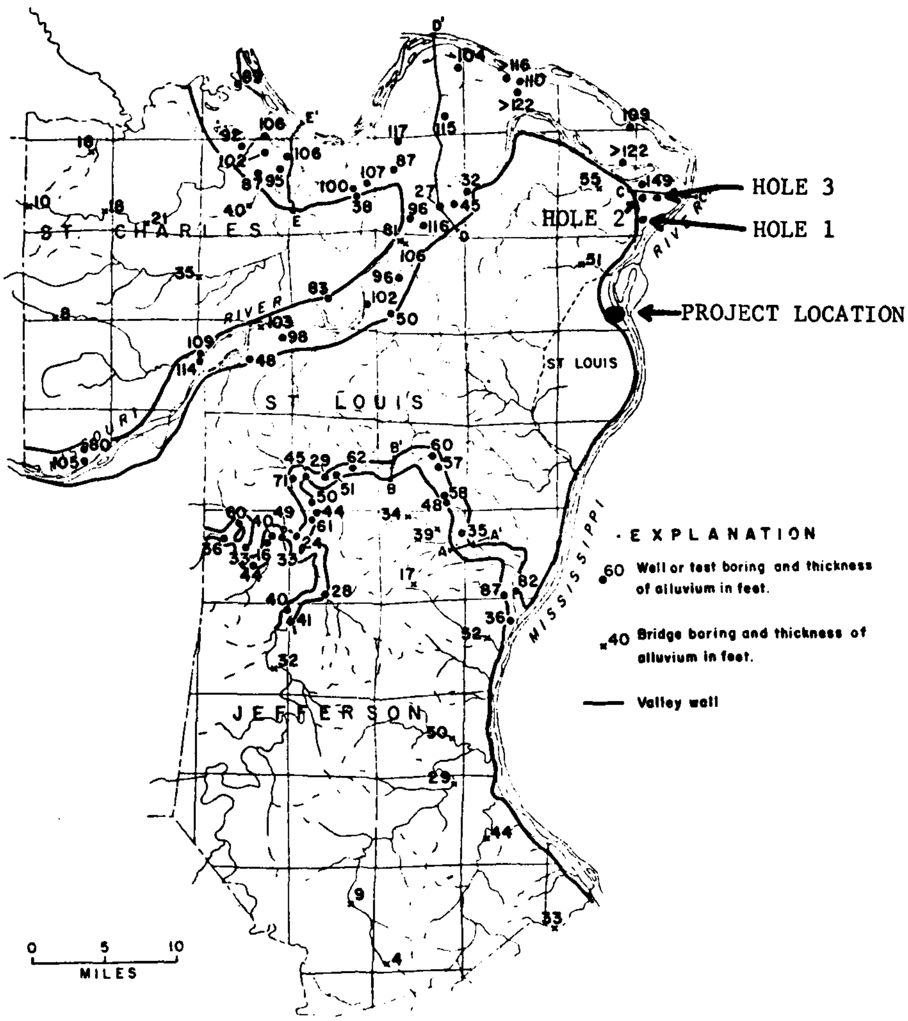
2.1.2.1.1 Project Site. Thickness of unconsolidated materials (landfill rubble and natural sediments) in the locale of the project site is rather uniform. Project test borings (STS Engineers, 1975) generally penetrated thicknesses of 38 to 44 feet at distances of about 250, 600, and 1500 feet east of Hall Street. The riverbank is about 1700 feet east of Hall Street. East-west and north-south subsurface profiles are shown in Figures 2-2 and 2-3, respectively. A plan view of borehole locations is given in Figure 2-4. The east-west profile crosses the northern end of the project site. The north-south profile is about 200 feet west of the riverbank. As shown in Figure 2-2, the test hole designated as B-9 is common to both profiles.

The area from Hall Street eastward for a distance of about 1200 feet has been used for disposing of rubble as revealed by the boring data (see holes B-3, B-7, and B-8 in Figure 2-2). The rubble is made up of cinders, glass, decaying wood, metal, bricks, etc. Thicknesses of the rubble penetrated is as much as 23 feet. On the basis of these data, the 45-acre site lies within an area that has been substantially disturbed by disposal of landfill rubble.

Clays, silts, and poorly sorted sands underlie the rubble. Boring data suggest that clays up to 20 to 30 feet thick predominate in the section near Hall Street and at the locations of bore holes B-12 and B-13 near the river. The clays are often plastic, gray, or gray and brown in color and on occasions exhibit slickenslides and rust stains.

As can be noted in Figures 2-2 and 2-3, the sediments tend to change from clays to silts and sands toward the east and north. In general, the boring data suggest that the sediments grade from a wedge of coarser sediments to a wedge of fine sediments in a northeast to southwest direction at and adjacent to the project site.

Depths to bedrock in the area between Hall Street and the line of the section of Figure 2-3, characteristically are between 38 and 44 feet. Elevations of the top of the bedrock in this same area range from a high of 400 feet to a low of 372 feet at the locations of holes B-4 and B-12/B-14, respectively. Average of all elevations at which bedrock was encountered by boring within this area is 382 feet.



(Reproduced and modified from Miller et al. (1974).)

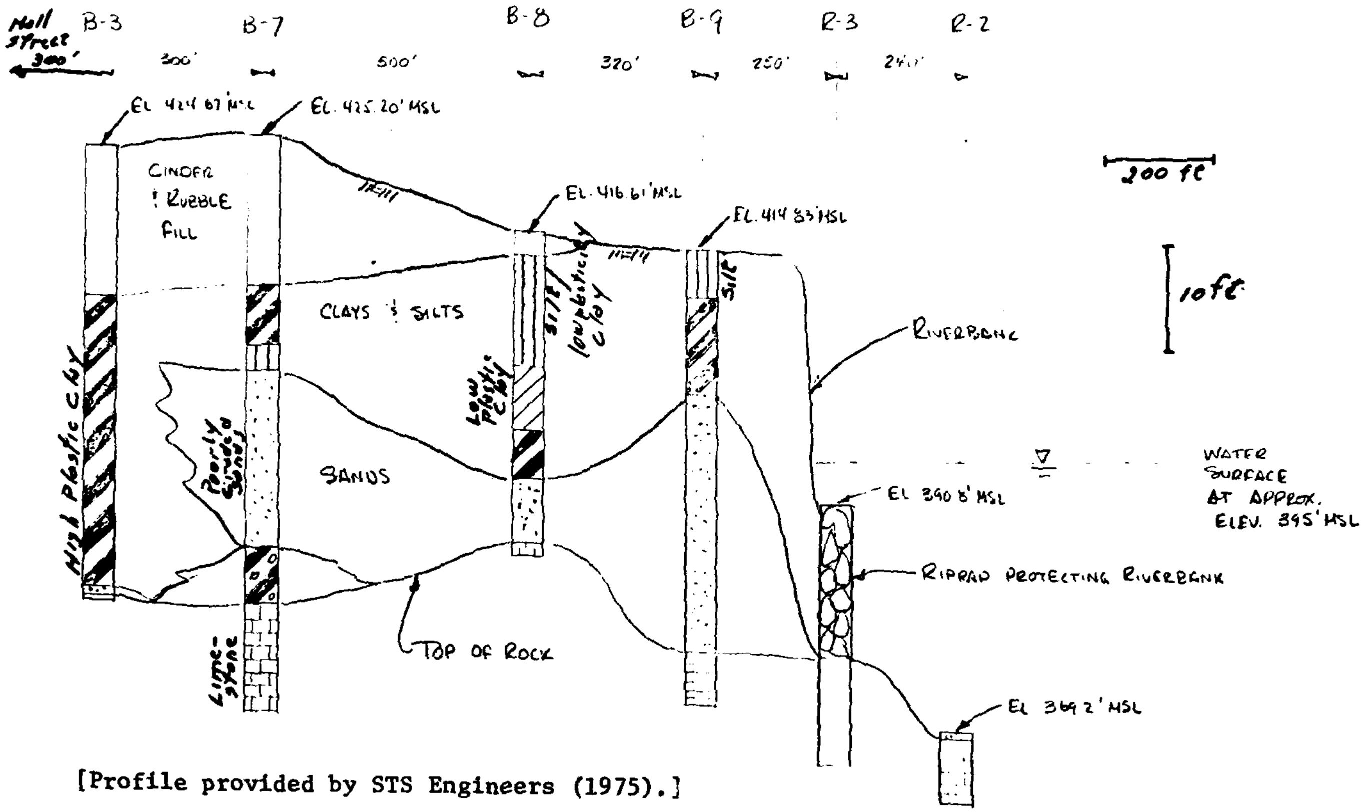
FIGURE 2-1. THICKNESS OF ALLUVIUM ALONG THE MISSISSIPPI, MISSOURI, MERAMEC AND LOWER BIG RIVERS, AND SOME TRIBUTARY STREAMS

TABLE 2-2. DRILLER'S LOGS OF ALLUVIAL DEPOSITS AT COLUMBIA BOTTOM(1)

Well/Boring	Description	Thickness, feet	Depth, top-feet	Elevation, top-feet
HOLE 1				
Surface elevation 413 ft (thickness rounded off to nearest foot)	Silt, clayey, brown, trace of fine sand	3	0	413
	Sand, fine, silty, brown	19	3	410
	Sand, medium to fine, gray	17	22	391
	Sand, medium, gray	7	39	374
	Limestone, hard, gray		46	367
			56TD[a]	357TD[a]
HOLE 2				
Surface elevation 424 ft	Silt, sandy, clayey, gray	2	0	424
	Sand, fine, silty, brown	5	2	422
	Clay, silty, sandy, gray	10	7	417
	Sand, medium, silty, clayey, gray	10	17	407
	Sand, medium to coarse, gray-brown; contains a trace of gravel	20	27	397
	Sand, coarse to very coarse, gray-brown; contains some gravel	15	47	377
	Sand, medium to coarse, gray-brown; contains some gravel	20	62	362
	Sand, fine to medium, silty, dark gray; contains trace of gravel	27	82	342
	Bedrock		109TD	315TD
HOLE 3				
Surface elevation 422 ft	Silt, sandy, clayey, gray	2	0	422
	Clay, silty, gray	5	2	420
	Silt, clayey, gray	5	7	415
	Clay, silty, sandy, gray	5	12	410
	Sand, very fine, silty, clayey, gray	15	17	405
	Sand, fine to medium, dark gray	15	32	390
	Sand, medium, some coarse, dark gray	25	47	375
	Sand, medium to coarse, dark gray; contains some gravel	46	72	350
	Bedrock		118TD	304TD

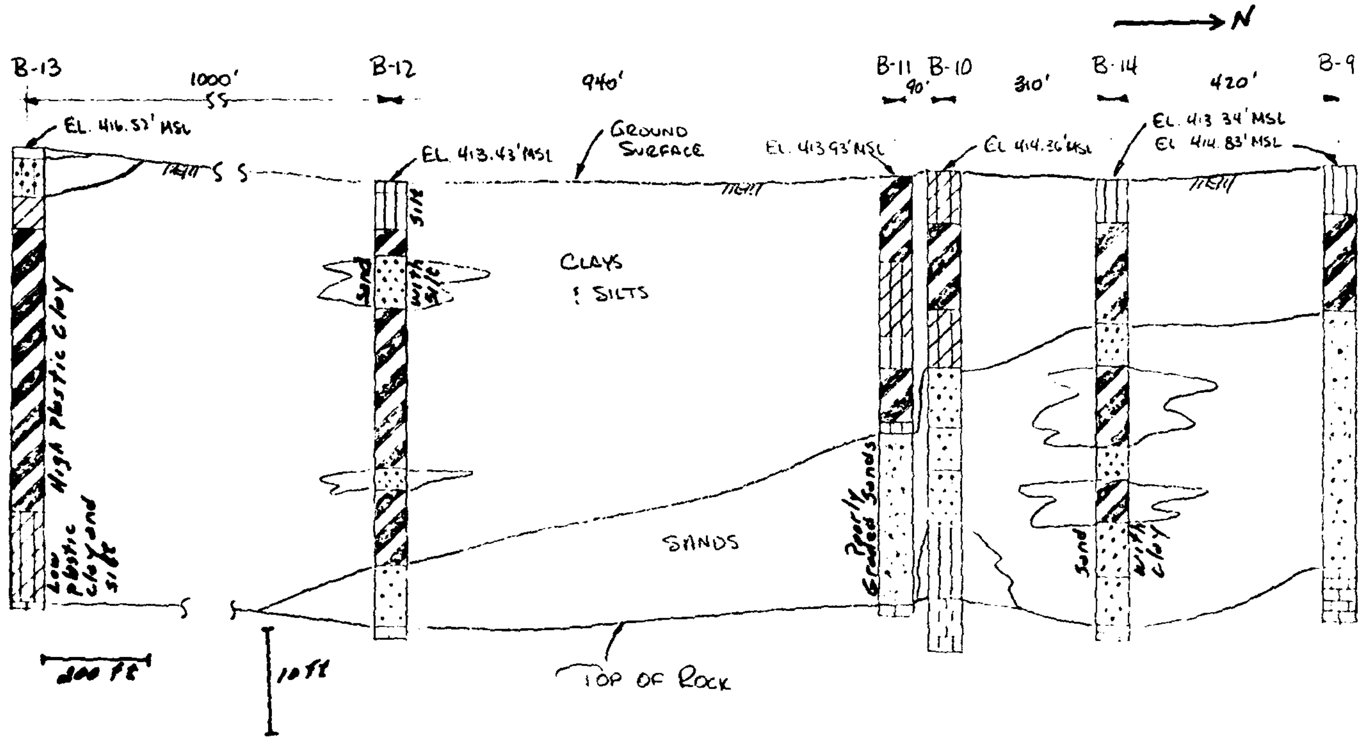
(a) TD = total depth.

(1) Based on data provided by L. Emmett, U.S. Geological Survey, Rolla, Missouri.



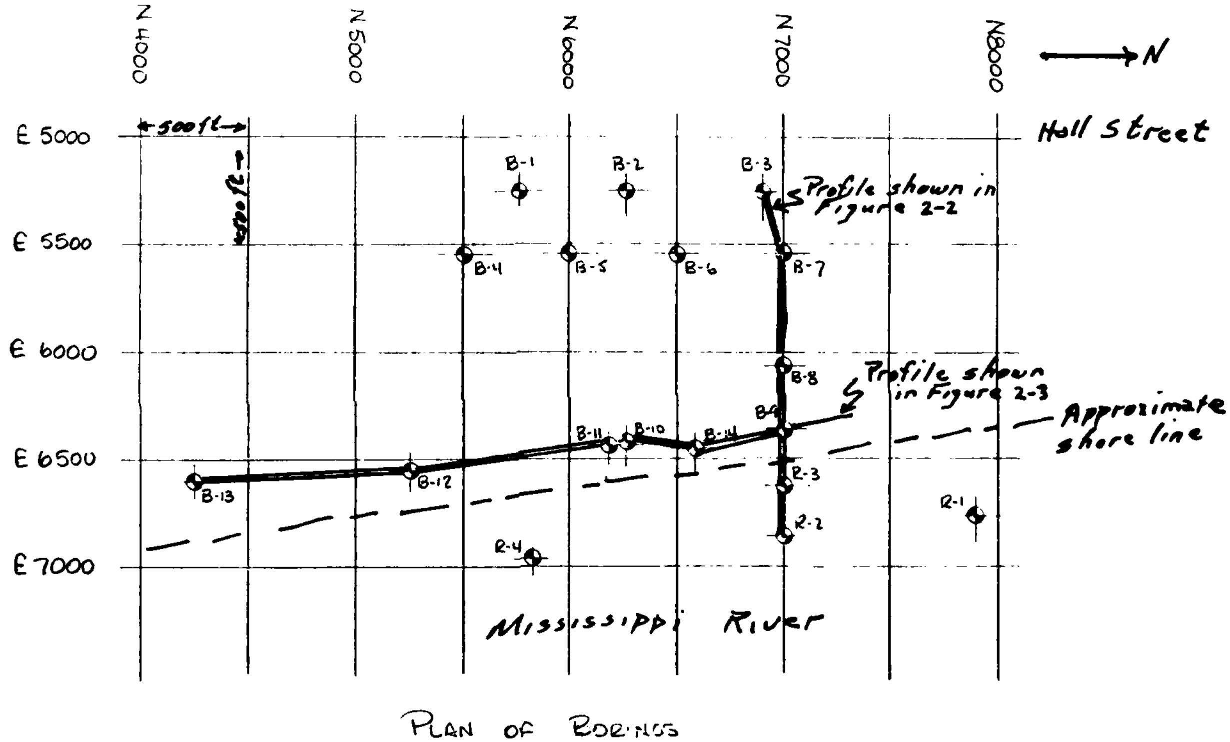
[Profile provided by STS Engineers (1975).]

FIGURE 2-2. EAST-WEST PROFILE THROUGH PROJECT SITE



[Profile provided by STS Engineers (1975).]

FIGURE 2-3. NORTH-SOUTH PROFILE BETWEEN PROJECT SITE AND MISSISSIPPI RIVER



[Plan provided by STS Engineers (1975).]

FIGURE 2-4. PLAN OF BORING LOCATIONS

Test holes in the riverbed near the shoreline (R-1, R-2, and R-4 in Figure 2-4; see also R-2 in Figure 2-2) indicate that the location of the dock facilities of the proposed project is not one of shoaling or sediment deposition. Only about 6 inches or so of sediments were penetrated before the top of the limestone bedrock was encountered at elevations of approximately 370 feet.

2.1.2.2 Structure

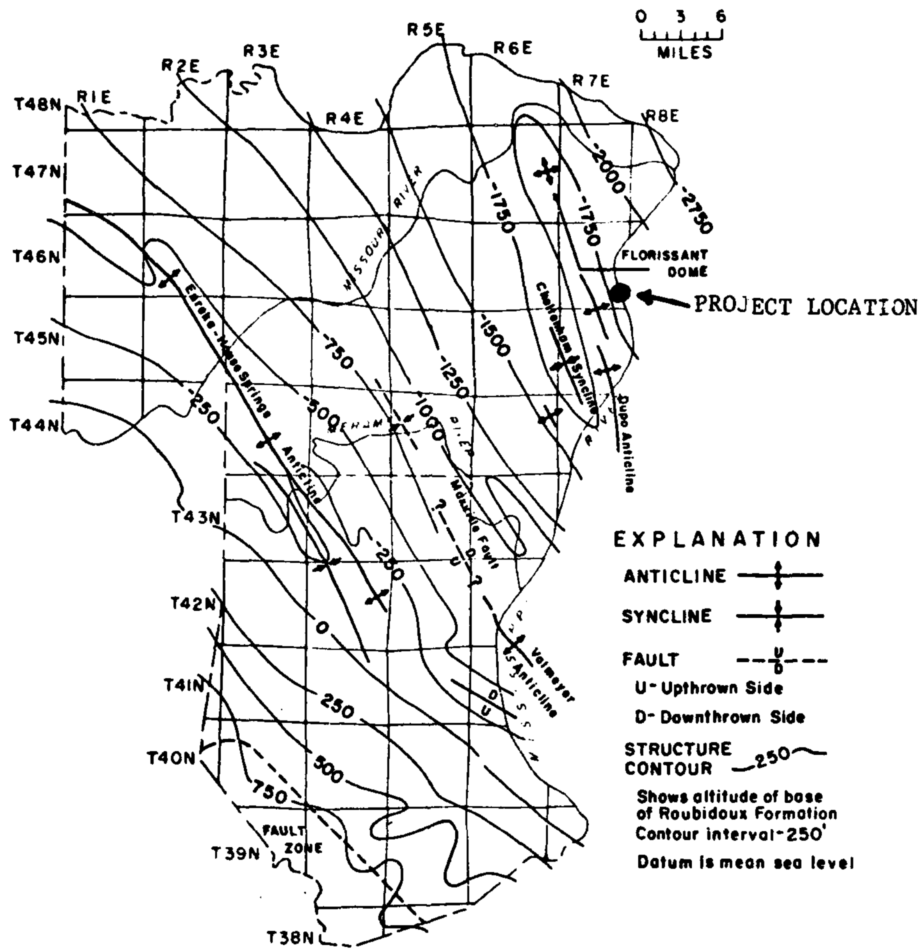
Major structural features of the region in which the proposed project is located are folds whose axes trend northwest-southeast (see Figure 2-5). Dips are in the neighborhood of 75 feet per mile. The project site is on the northeast flank of a regional structure known as the Florissant Dome.

Strike of the faults depicted at some distance west of the project site in Figure 2-5 is parallel to the axes of folding. A Corps report (Corps of Engineers, 1974) shows the St. Louis fault (see Figure 2-6) with a north-west strike to be in the immediate vicinity of the project site.

2.2.2.3 Earthquakes

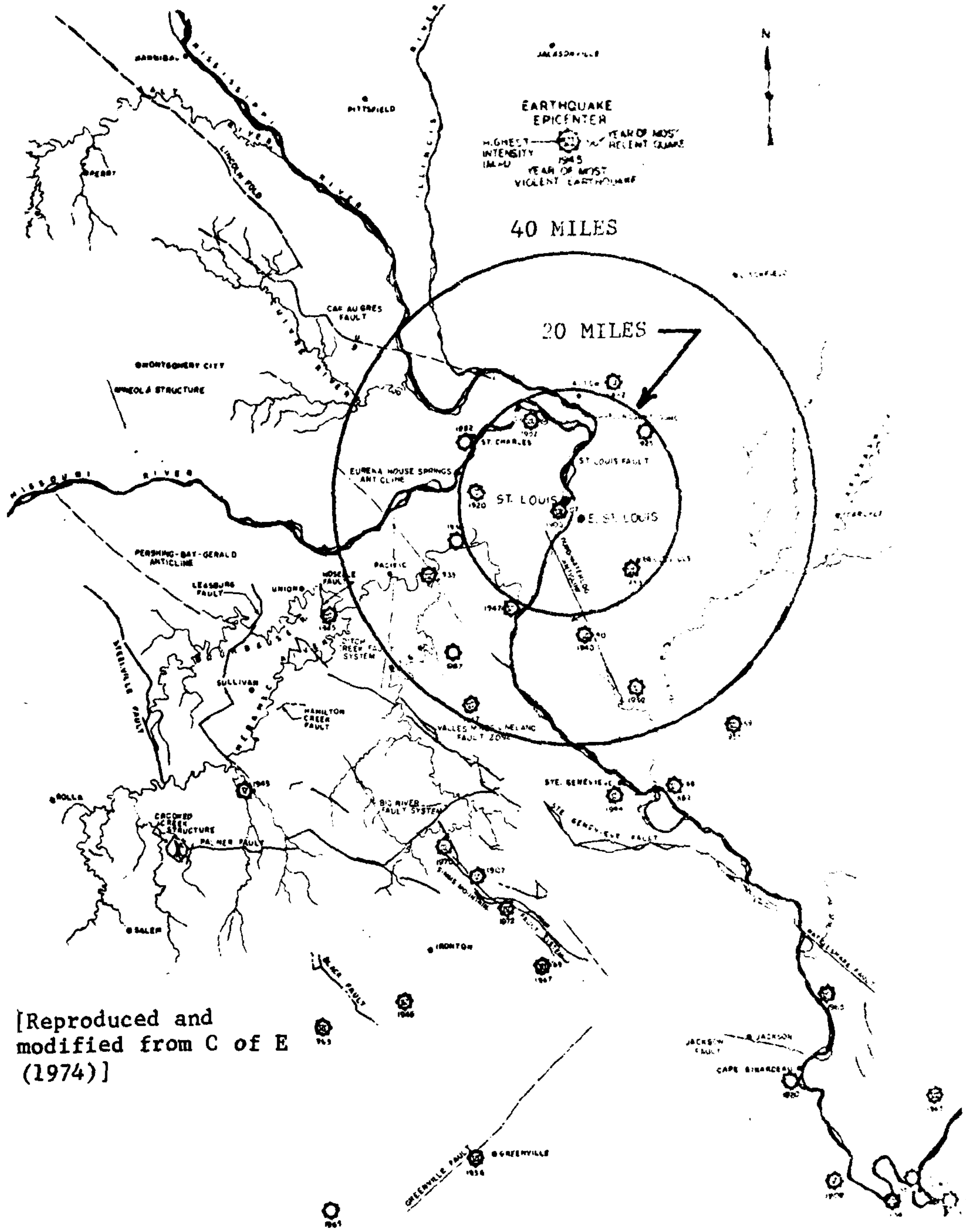
The St. Louis vicinity is not known historically as an area of damaging earthquakes. Shown in Figure 2-6 are epicenters of the most recent and greatest intensity (modified Mercalli) earthquakes. With one exception, no earthquakes with intensities equal to or greater than VII (the intensity at which some structural damage generally begins to occur to poorly built buildings) are indicated in the figure (Corps of Engineers, 1974). The exception is an intensity VII earthquake that occurred at St. Louis in 1903.

St. Louis is in the felt area of the large earthquake events which occurred in 1811/1812 at New Madrid in southeast Missouri. These earthquakes, discussed below, resulted in intensities VII and VIII being felt at St. Louis (Nuttli, 1973). (Damage to well-constructed buildings commences at intensity VIII.) Howell (1974), from his work on seismic regionalization, arrived at research results suggesting that the seismic province in which St. Louis is located could experience an earthquake of VII or less once every 100 years.



(Reproduced and modified from Miller et al. (1974).)

FIGURE 2-5. MAJOR STRUCTURAL FEATURES OF THE ST. LOUIS AREA AND STRUCTURAL CONTOURS ON THE BASE OF THE ROUBIDOUX FORMATION



[Reproduced and modified from C of E (1974)]

FIGURE 2-6. SEISMIC ACTIVITY

Seismologists have considerable interest in the Mississippi River valley, particularly within a large region centered on New Madrid, 150 miles southeast of St. Louis, and near the boundary between Kentucky and Tennessee. The interest stems from the fact that in the winter of 1811/1812, three great earthquake shocks, whose epicenters were in the New Madrid vicinity, occurred in what might otherwise be considered as a minor seismic region in the interior of a nominally aseismic block (Richter, 1958; Lammlein, et al., 1971; and Nuttli, 1973). These great shocks of intensities X-XII occurred on December 6, January 23, and February 6. Richter (1958) believed that one of the shocks must have been the largest known earthquake in the contiguous U.S. On the basis of the large region in which they caused damage and were felt or perceptible, Nuttli (1972) also ranked these earthquakes as the largest since Europeans settled North America. Research has indicated that the Mid-Atlantic coastal areas experience intensity values of V. Intensities of VII and VIII occurred in the St. Louis locale. The total area of potential damage (intensity ≥VII) has been estimated at 232,000 square miles as compared to 11,600 square miles for the 1906 San Francisco earthquake (Nuttli, 1973).

Epicenters of other and more recent shocks of lesser intensity are also located in the New Madrid locale, e.g., five earthquakes with a maximum intensity of V in the first 7 months of 1962 (Stauder and Bollinger, 1963).

2.1.3 LOCAL ELEMENTS OF THE MISSISSIPPI RIVER SYSTEM

The city of St. Louis is located near the center of the Mississippi River's very large drainage system. The dock facility of the rail-to-barge coal transfer terminal will be at Sawyer Bend of the river and inside the riverward harbor line between river miles 184.5 and 185.

Prior to modification by man, the Mississippi River flowed through a broad valley with rapidly shifting channels. Sand bars were deposited and eroded with each heavy runoff. In some areas, banks eroded away while at other sites, islands were formed and banks enlarged. Along the shifting river channels, sloughs, oxbow lakes at meander cut-offs, and wetlands were common. The construction of deflector dikes and levees, the stabilization of banks, and the maintenance of channels all have contributed to a reduction in the dynamic character of the river valley. These measures, employed since the 1890's, have tended to narrow and stabilize the area through which the river water flows. The construction of dams during the 1930's has had the effect of widening the river and creating slack water areas. The hydrology of the river valley today reflects extensive modifications of previous flow characteristics and probably also increased flow volume as a result of increasing runoff from urban and agricultural land (Corps of Engineers, 1974).

2.1.3.1 River Channels and Discharges

The Missouri River joins the Mi[illegible] stream from the proposed project. Downstream from [illegible] just south of the project location, waters [illegible] through as many as three principal channels [illegible] channels are (1) the main stem of the river in which the boundary between the states of Missouri and Illinois is located, (2) [illegible] chute or channel between Mosenthein and Cabaret Islands, and (3) [illegible] mercially navigable Chain of Rocks Canal.

One dam and one lock are located in the [illegible] the low-water weir-type Dam 27 in the main stem [illegible] just south of the Chain of Rocks Bridge, and Lock 27 in the Chain of Rocks Canal. Lock 27 is the southernmost lock in the Mississippi [illegible] Normal pool elevation between the mouth of the Missouri River and Dam 27 and in the Chain of Rocks Canal is 398 feet.

The Meramec River in the State of Missouri [illegible] Mississippi River 23 river miles downstream from [illegible] Several smaller streams in Missouri are tributary to [illegible] River in the intervening distance. No major rivers in the State of Illinois discharge to the Mississippi River in the general vicinity of the project. However, several ditches or small canals drain the [illegible] Illinois floodplain.

Stream gages are located on the Mississippi River [illegible] miles [illegible] stream at Alton, Illinois, and 5 miles downstream from the [illegible] at the Eads Bridge in St. Louis. Discharge data at these [illegible] shown in Table 2-3 for the water year 1972. Flow of the river at these two locations is affected by many upstream reservoirs and [illegible] dams on the Mississippi River and many reservoirs and diversions for irrigation in the Missouri River Basin.

Extremes in daily discharge and water elevations for period of record at the Alton and St. Louis gages are given below in units of cubic feet per second and feet elevation, respectively.

	Discharge			
	Alton	Date	St. Louis	Date
Maximum	535,000	Apr. 29, 1973	1,019,000	June [illegible]
Minimum	7,960	Nov. 7, 1948	18,000	Dec. [illegible]

TABLE 2-3. MISSISSIPPI RIVER DISCHARGE DATA, WATER YEAR 1972

(Cubic Feet per Second)

	Station 05587500			Station 07010000		
	Max	Mean	Min	Max	Mean	Min
October, 1971	54300	44080	32400	115000	102400	86000
November	88500	76300	54800	167000	145200	117000
December	193000	96020	69000	334000	176000	130000
January, 1972	111000	62330	44300	181000	111100	77500
February	57300	50100	40800	106000	88580	71600
March	172000	128600	60600	248000	185300	105000
April	229000	185700	155000	382000	262300	213000
May	263000	208600	117000	404000	321000	199000
June	153000	117200	90000	231000	186300	159000
July	127000	95240	63700	197000	155000	116000
August	203000	150300	108000	258000	212000	169000
September, 1972	145000	123900	92100	271000	201300	160000

Station 05587500: Alton, Illinois, 7.7 miles upstream from Missouri River at River Mile 202.7. Drainage area 171,500 square miles.

Station 07010000: St. Louis, Missouri, Eads Bridge, 15.9 miles downstream from Missouri River at River Mile 180. Drainage area 706,000 square miles.

Data from USGS (1972).

			Water Level	
Maximum	432.15	Apr. 20, 1973	423.17	Apr. 28, 1973
Minimum	390.50	Jan. 27, 1973	373.83	Jan. 16, 1940

The area drained by the Mississippi River at the Alton gage is 171,500 square miles. By the time the river reaches the St. Louis gage, 23 river miles downstream, it is draining 706,000 square miles of land area, an increase of 534,500 square miles. Over 98 percent of this increase is area drained by the Missouri River which discharges to the Mississippi River between the locations of the two gages. Thus, as evidenced in the flow data in Table 2-3 a very significant percentage of water flowing by the project site is from the Missouri River basin.

2.1.3.2 Civil Works

Before the spring flood of 1973, approximately 60 percent of the Mississippi River's waters flowed by the project site through the main stem at Sawyer Bend and 40 percent through the distributary chute or channel—between Mosethein and Cabaret Islands (see Figure 2-7). Subsequent to that flood, the situation has reversed with approximately 60 percent of the flow through the distributary channel (Corps of Engineers, 1975).

The Corps of Engineers has completed the first phase of a planned two-phase project to divert flow back to Sawyer Bend. This phase involved rehabilitation of dikes north of Mosenthein Island on the Illinois side of the river at river miles 189.3 and 189.6 (see Figure 2-7). Physical model studies indicated that these dikes should divert flow back to Sawyer Bend as well as reduce shoaling or sedimentation in this main stem channel (Corps of Engineers, 1975). It is too soon to draw any firm conclusions on the success of the first phase, but early evidence suggests that sedimentation may have been reduced at the dock of the Missouri-Portland Cement Company at river mile 187.6 (Zans, 1975).

Riverbed model studies of this reach of the river have just been completed at the Waterways Experiment Station, Vicksburg, Mississippi. These studies included examination of a possible dike at the north end of Mosenthein Island extending west from the left (Illinois) bank, to provide partial closure; several shorter dikes along the west bank of Mosenthein Island; one at the southern end of the island whose western end would be 1800 feet from the Missouri bank (Corps of Engineers, 1975); and one from the right (Missouri) bank at Sawyer Bend.

The findings of this study were that a navigation channel at Sawyer Bend can be reestablished. Based on the model study, the formerly contemplated dike at the southern end of Mosenthein Island will not be needed, nor will there be a need for a dike at Sawyer Bend on the right

bank. The channel may be very narrow in the vicinity of river mile 184.7 at low water; at high stages there will be no problem.

On the Missouri side of the main stem at the project site, test borings for the proposed dock facilities penetrated only a thin veneer of bottom sediments before striking bedrock. This suggests that the dock facilities will be located in either an area of bottom scour or an area where flow velocities are generally sufficient to prevent deposition of the river's sediment load. However, the effects that the recently rehabilitated dikes at the north end of Mosenthein Island have had or will have on scouring, shoaling, and flow velocities in the dock and navigation areas of the proposed project are undetermined.

Since construction of the Chain Rocks canal, there has been no government dredging of the main stem of the Mississippi River west of the canal. This reach of the river, up to Dam 27, will be maintained by the government, although as indicated above, no need for future dredging is anticipated after the diversion works are in place. No maintenance dredging in this reach of the river is programmed or planned.

Some contract dredging has been conducted about 3 miles upstream from the project site at the barge loading facility of the Missouri Portland Cement Company (Zans. 1975). Prospective government dredging (unrelated to the proposed project) and dredging disposal areas upstream from the proposed terminal are depicted in Figure 2-7.

A hydrographic survey conducted by the applicant on April 22, and 23, 1975, showed generally adequate depth in the docking and maneuvering area, except in the loaded barge area just downstream of the loader, where rock was encountered. It was at first believed to be bedrock and that blasting would be required. More extensive investigation disclosed that the hump encountered consisted of random-sized rock. On the basis of old Corps records, this appears to be the remains of a toe dike constructed by the Corps in the 1880's to protect the right bank at the lower end of Sawyer Bend. The original landfill behind the dike subsequently washed out, producing the configuration now existing. The top portion of the dike rock evidently was used by the Corps as a source of rock for the bank during the construction of the St. Louis floodwall. A general plan of the loaded barge area showing bottom contours and the location of the rock is shown in Figure 2-8.

Cross-sections illustrating the relationship of the rock pile to the draft of a fully loaded barge is illustrated diagrammatically in Figure 2-9. The volume of rock estimated to be contained in the hump is approximately 7,500 cubic yards.

In order to provide adequate clearance for the barges and towboats, it may be necessary to remove this rock; if removed it will be placed on the bank as specified by the Corps of Engineers. Other than this, no other river work will be necessary; dredging will not be required and is not planned. As indicated by Figure 2-9, bedrock is at

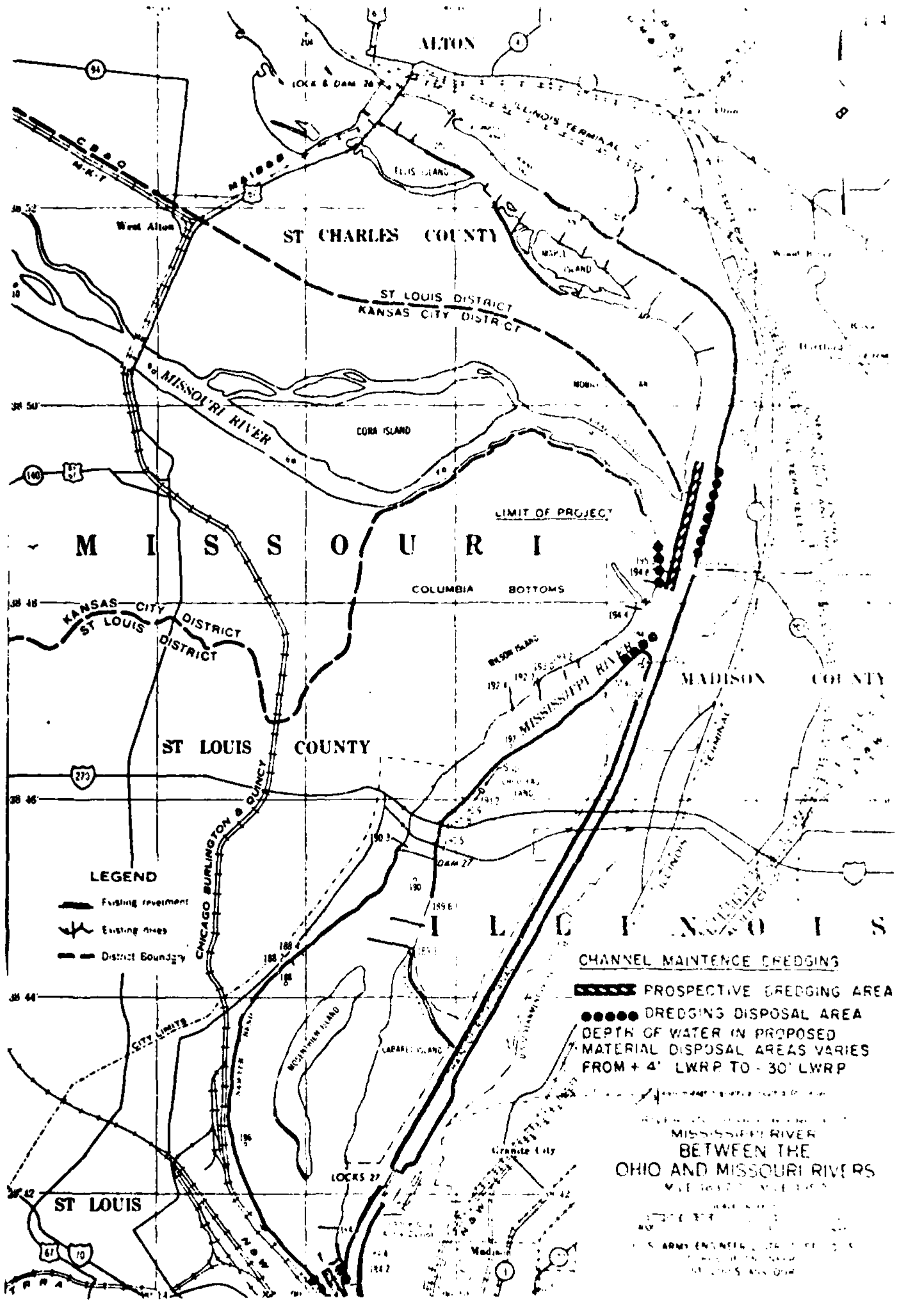


FIGURE 2-7. DREDGING AND DREDGING DISPOSAL AREAS
(From C of E, 1975)

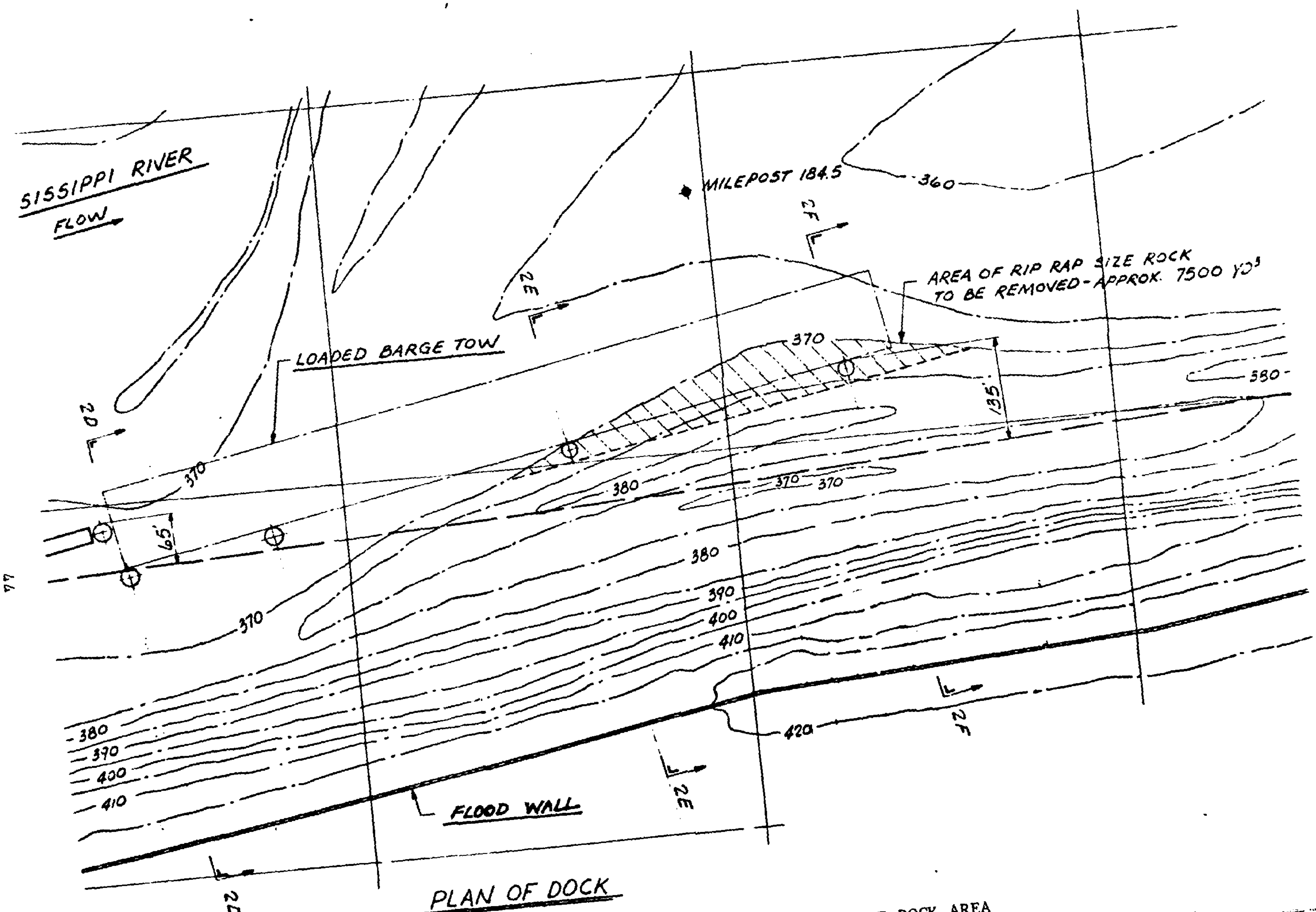


FIGURE 2-8. RIVER BOTTOM CONTOURS IN LOADED BARGE DOCK AREA

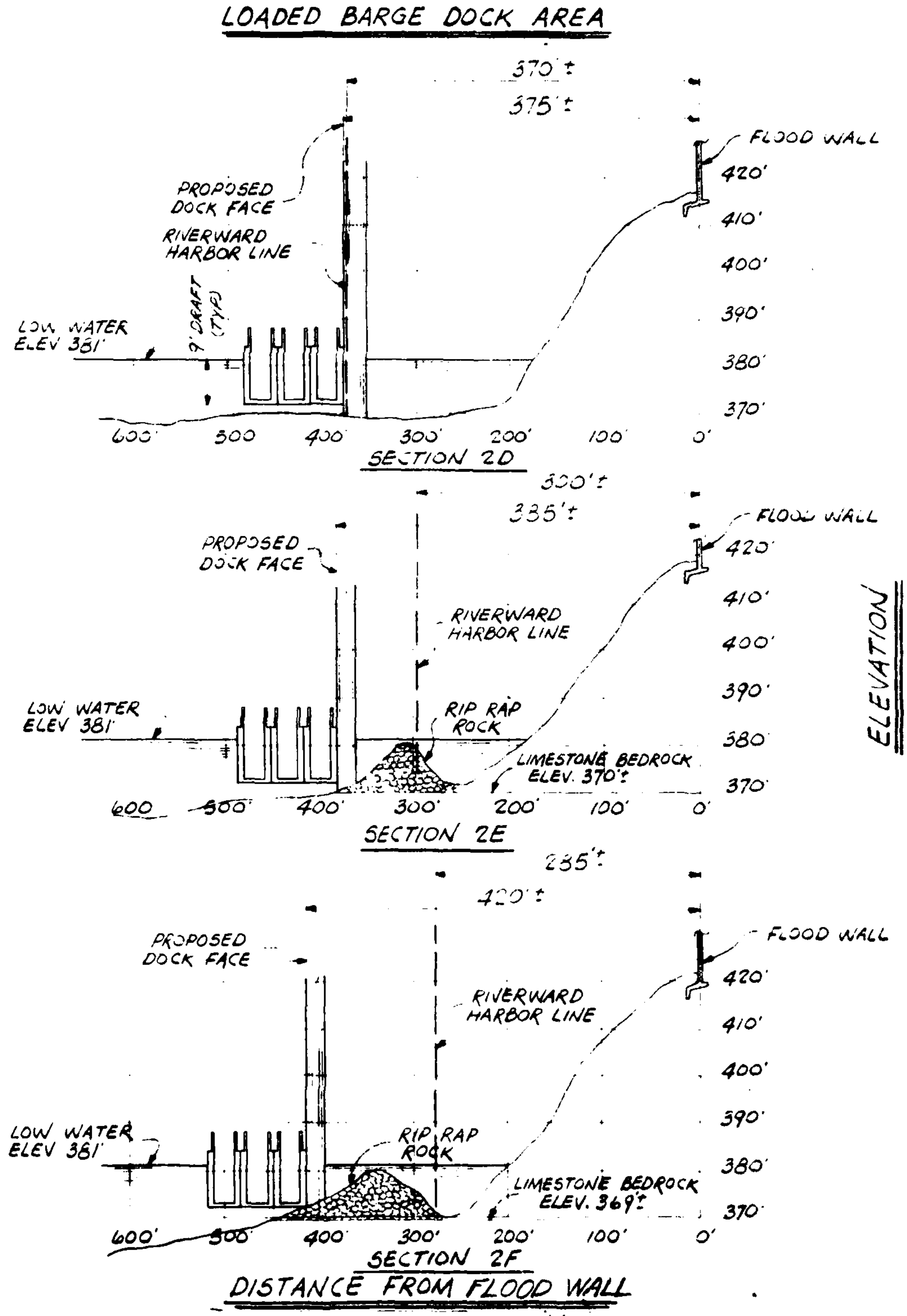


FIGURE 2-9. DIAGRAMMATIC CROSS-SECTIONS AT LOADED BARGE DOCK AREA.

about 370 feet ± 2 feet, and there is only a thin veneer of bottom sediments overlying this bedrock. This appears to indicate that the dock area is fairly well scoured by the river, and is not a zone of accretion.

Present commercial traffic navigating the Sawyer Bend channel consists of the towboats and barges serving the Missouri Portland Cement Company and the St. Louis Grain Corporation. The northern end of the latter company's dock and barge loading facility is approximately at river mile 184.1.

2.1.3.3 Project Site Surface Drainage

No storm sewers exist at the project site. The city of St. Louis north-south floodwall east of the site prevents any runoff from the site from flowing directly east to the Mississippi River. Site runoff either drains generally northward along an existing natural drainage ditch to the Harlem South Pond or to intervening topographic depressions with closures of up to 3 or 4 feet.

Harlem South Pond of the St. Louis Sewer District, just to the north (see Plate 1), is in the former and now flood-protected floodplain of the Mississippi River west of river mile 185. Runoff reaching this point is discharged to the river via a storm sewer connecting the pond to the Harlem Outfall at river mile 185. Flow is by gravity except when river levels require that the water be pumped.

Some of the runoff, as indicated above, drains to closed topographic depressions. Standing water is often present in these basins. Water trapped in these basins is either internally drained by percolating downward into the underlying unconsolidated materials or evaporating into the atmosphere. Annual lake evaporation in the St. Louis area is in the neighborhood of 36 inches of water.

No perennial streams terminate at, flow through, or begin in the project site. The elevation of the site near its border with Hall Street is one to two feet higher than Hall Street. This difference in elevation probably serves to divert at least most of the runoff from uplands to the west around the site.

2.1.3.4 Project Site Groundwater

Groundwater conditions prevailing in the former floodplain area that includes the project site are without much doubt analogous to those prevailing in some other nearby floodplains. This is because the sheet pile curtain under the City of St. Louis' floodwall rests on

bedrock or depth of refusal.* The floodwall structure is a north-south barrier in the unconsolidated sediments to the easterly flow of subsurface waters to the river. Piezometric surfaces (Schicht, 1965) in the American Bottoms on the Illinois side of the Mississippi River show that the direction of flow of subsurface water has a major down gradient component perpendicular to the river. A less extensive study of groundwater levels in the floodplain at Columbia Bottom also gave similar results (Battelle, 1974).

Because of the floodwall structure, groundwaters in the unconsolidated subsurface material at the project site and immediate locale very probably migrate southward parallel to the river to an area that is south of the floodwall before becoming available as recharge water for the Mississippi River. Departures from this expected pattern depend on the extent to which the limestone bedrock of the locale is jointed and the orientation of the joints.

Knowledge of the subsurface hydrology of unconsolidated sediments in the floodplain on the Missouri side of the Mississippi River is not well developed. During boring of project test holes, water entered the bore holes at depths ranging from 2.5 to 13 feet. Elevations at which the water entered the holes ranged from 406 to 416 feet (STS Engineers, 1975). An extensive study of groundwater at American Bottoms in Illinois has been conducted (Schicht, 1965). Coefficients of permeability reported in that study range from about 1,100 to 2,900 gallons per day per square foot. Specific capacity of 32 wells ranged from 15 to 266 gallons per minute per foot of drawdown in water level, depending on pumping duration, well diameters, and properties of the unconsolidated aquifer.

Potable groundwater is available from Mississippian limestones over much of St. Louis County. Most limestone wells in the county yield a maximum of 10 to 15 gallons per minute (Lutzen and Rockaway, 1971).

2.1.4 WATER QUALITY

2.1.4.1 Mississippi River

The reach of the Mississippi River at St. Louis is a part of Zone 2 within the Missouri Clean Water Commission's (MCWC) Mississippi

* This sheet pile curtain wall was installed expressly to prevent water movement beneath the flood wall which might weaken it.

River--Main Stem terminology. (MCWC, 1973). Zone 2 runs from Alton Lock and Dam on the north to the Arkansas state line on the south. Water uses designated by MCWC for this reach of the river are listed in Table 2-4. MCWC has assigned a "B" classification to Zone 2. All classified streams are assumed to have aesthetic value, to receive surface runoff, and to be used for wildlife watering. Quality of waters assigned to "B" classification are not suitable for primary-contact recreation.

Water distributed by the City of St. Louis' Chain of Rocks Water Treatment Plant at Dam 27 is drawn from the Mississippi River at river mile 190.3 which is 5.4 miles upstream from the proposed project. Data (Zollman, 1974) on water quality at this location are shown in Tables 2-5 and 2-6. Water samples were collected on the discharge side of a pump that furnishes raw water to a settling basin.

Extremes in daily sediment concentration and load and temperature for the period April, 1948, to September, 1972, at the Poplar Street Bridge (River Mile 179.1) in St. Louis are given below (USGS, 1972).

	Maximum	Minimum
Sediment Concentration, mg/l	6,420	19
Sediment Load, tons/day	7,010,000	2,800
Temperature, C (F)	32 (89.6)	Freezing

2.1.4.2 Groundwater

Samples of groundwater at the project site will be collected and analyzed prior to delivery of any coal to the terminal.

Data on quality of ground water at or near Columbia Bottom 10 miles north of the project site are given in Table 2-7.

2.1.5 CLIMATOLOGICAL ELEMENTS

Official hourly weather observations are made at Lambert Field, a higher elevation 10 miles west of the Hall Street area. Average yearly mean speed is 9.5 m.p.h. Prevailing winds are in a southerly direction during summer and fall and northwest and west-northwest in winter and spring. Maximum observed wind speed is approximately 60 m.p.h., from a southeasterly direction. (Data source - U. S. Department of Commerce, 1971.) As a consequence of its location along the Mississippi River, the coal transfer facility will experience winds which follow the general direction of the river valley in comparison to winds at the airport with its unobstructed location at a higher elevation. Thus, there should be a slightly greater frequency of south-southwest and

TABLE 2-4. WATER USES - MISSISSIPPI RIVER AT ST. LOUIS, MISSOURI

Uses	Present	Future
Irrigation	Yes	Yes
Livestock watering	Yes	Yes
Propagation of commercial fish	Yes	Yes
Propagation of warm-water sportfish	--	--
Propagation of cold-water sportfish	--	--
Industrial cooling water	Yes	Yes
Industrial process water	Yes	Yes
Drinking-water supply	Yes	Yes
Hydroelectric power	--	--
Boating and canoeing	--	--
Fishing	Yes	Yes
Whole-body-water-contact recreation	--	--
Receive effluents	Yes	Yes

Data Source: MCWC (1973).

TABLE 2-5. DISSOLVED METALS – MISSISSIPPI RIVER CHAIN OF ROCKS PLANT OF ST. LOUIS WATER DIVISION

(Milligrams per Liter)

	1973											
	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec
Silver	.0030	.0016	.0017	.0012	.0020	.0013	.0020	.0019	.0020	.0042	.0040	.0017
Aluminum	.046	.044	.058	.024	.011	.020	.026	.010	.010	.028	.018	.028
Barium	.068	.076	.057	.078	.091	.040	.050	.135	.110	.098	.071	.080
Cadmium	.0022	.0019	.0024	.0078	.0026	.0101	.0040	.0071	.0110	.0073	.0020	.0010
Chromium	.005	.005	.0031	.0023	.0030	.0038	.0050	.0033	.0040	.0027	.0040	.0017
Copper	.0092	.0084	.0120	.0118	.0110	.0125	.0090	.0092	.0080	.0118	.0120	.0104
Iron	.065	.046	.076	.042	.019	.028	.033	.023	.016	.040	.028	.040
Mercury	.0003	.0001	.0005	.0001	.0009	.0001	.0005	.0001	.0001	.0001	.0002	.0001
Potassium	4.6	5.0	5.3	4.0	4.2	5.4	5.5	5.7	5.4	5.1	5.6	4.9
Manganese	.017	.026	.012	.0074	.0055	.0050	.0050	.0030	.0050	.0058	.0080	.0115
Sodium	17.0	20.0	15.5	13.5	21.0	29.0	30.0	31.0	48.0	14.0	25.0	22.0
Nickel	--	--	--	.005	.022	.015	.013	.009	.010	.009	.009	.010
Lead	.005	.003	.002	.003	.002	.002	.005	.005	.005	.005	.005	.005
Zinc	.0128	.0130	.0170	.0160	.0160	.0230	.0140	.0113	.0140	.0109	.0160	.0141
Silica	5.3	5.6	5.1	5.3	6.0	5.7	6.0	5.0	5.3	6.1	6.2	6.5
Strontium	--	--	--	--	--	--	--	--	.44	.25	.98	.37

TABLE 2-6. MISSISSIPPI RIVER WATER ANALYSIS DATA - CHAIN OF ROCKS PLANT OF ST. LOUIS WATER DIVISION

Description *		1972 Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	1973 Mar	Year
Color	Max	24	27	25	18	20	30	24	22	20	40	32	30	40
	Min	8	13	10	10	10	10	6	10	10	12	9	12	6
	Avg	13	20	14	13	15	19	16	15	14	27	24	24	18
Temperature, F	Max	62	76	80	85	85	80	70	55	41	41	40	51	85
	Min	47	59	74	76	77	70	53	42	32	33	34	40	32
	Avg	55	66	77	81	82	71	62	47	35	36	37	48	58
pH	Max	8.50	8.25	8.40	8.45	8.30	8.25	8.40	8.30	8.20	8.05	8.20	8.10	8.50
	Min	8.12	7.90	8.10	8.05	8.10	7.85	8.00	8.00	7.90	7.65	7.90	7.70	7.65
	Avg	8.24	8.07	8.20	8.28	8.19	8.12	8.11	8.11	8.05	7.83	8.01	7.84	8.10
Phenolphthalein alkalinity	Max	0	0	0	1	3	1	1	0	0	0	0	0	3
	Min	0	0	0	0	0	0	0	0	0	0	0	0	0
	Avg	0	0	0	0	0.5	0	0	0	0	0	0	0	0
Total alkalinity	Max	160	172	167	169	162	158	157	155	179	179	182	170	182
	Min	114	117	146	138	130	111	148	111	138	100	105	101	100
	Avg	140	142	158	158	149	141	154	139	162	132	138	121	144
Noncarbonate hardness	Max	73	71	90	89	85	78	84	64	72	54	51	48	[illegible]
	Min	38	40	64	55	59	28	59	36	43	25	12	17	12
	Avg	59	59	75	74	69	56	71	50	55	37	28	30	55
Total hardness	Max	226	235	250	251	239	235	240	219	239	220	226	204	251
	Min	157	160	210	193	190	139	209	154	188	132	120	121	[illegible]
	Avg	199	201	233	233	218	197	225	189	217	169	166	151	[illegible]
Bacteria, std plate count	Max	14,500	15,000	25,000	49,000	42,000	84,000	27,000	18,000	15,000	90,000	[illegible]	[illegible]	[illegible]
	Min	950	1,200	1,400	750	2,800	1,000	700	2,800	1,300	500	[illegible]	[illegible]	[illegible]
	Avg	3,500	5,000	9,200	12,000	14,000	15,000	6,600	9,000	4,700	14,000	[illegible]	[illegible]	[illegible]
Coliform bacteria per 100 ml	Max	380,000	370,000	265,000	110,000	90,000	230,000	86,000	113,000	80,000	[illegible]	90,000	[illegible]	[illegible]
	Min	6,000	6,000	9,000	4,300	3,300	8,000	400	10,000	[illegible]	[illegible]	10,000	[illegible]	[illegible]
	Avg	44,000	54,000	79,000	37,000	39,000	52,000	34,000	44,000	30,000	24,000	29,000	[illegible]	[illegible]
Calcium, Ca	Max	61.2	64.4	65.6	66.4	63.2	59.6	62.8	58.0	[illegible]	[illegible]	66.8	61.2	[illegible]
	Min	44.0	42.4	54.4	51.2	48.0	38.4	51.2	42.4	[illegible]	[illegible]	38.2	36.8	[illegible]
	Avg	54.0	55.6	62.4	61.2	58.4	52.4	58.4	49.2	[illegible]	[illegible]	49.2	[illegible]	[illegible]
Magnesium, Mg	Max	18.7	18.7	22.3	22.8	21.1	21.0	21.1	[illegible]	20.1	17.7	[illegible]	14.8	[illegible]
	Min	9.7	12.1	14.5	16.2	12.6	10.1	15.5	11.3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Avg	15.5	15.1	18.6	19.5	17.5	16.2	19.2	[illegible]	16.5	[illegible]	10.6	[illegible]	[illegible]
Carbonate, CO_3		0.0	0.0	0.0	0.0	0.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		
Bicarbonate, HCO_3		170.8	173.2	192.8	192.8	181.8	[illegible]	187.9	169.6	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Sulfate, SO_4		124.9	98.7	165.9	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Chloride, Cl		19.0	18.5	25.0	23.5	19.5	[illegible]	17.5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Nitrate, NO_3		3.2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fluoride, F		0.43	0.39	0.42	0.48	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
Suspended solids	Avg	230	406	318	257	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
Dissolved solids	Avg	378	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	405	[illegible]	[illegible]	[illegible]	[illegible]		
Turbidity	Max	750	[illegible]	[illegible]	[illegible]		[illegible]		[illegible]		[illegible]			
	Min	130	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]						
	Avg	276	[illegible]	427	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]			
Coefficient of fineness	Avg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]					
Phosphate, PO_4	Avg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]						

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
[illegible]	Max	13.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Min	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Avg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	Max	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Min	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Avg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

TABLE 2-7. SELECTED GROUNDWATER-ANALYSIS DATA - COLUMBIA BOTTOM AND MISSOURI RIVER VALLEY ALLUVIUM

(Milligrams per Liter)

	Sampling Sites		
	1[a]	2[b]	3[c]
Temperature, C (F)	14 (57.2)	14 (57.2)	16 (60.8)
Silica (SiO_2)	24	30	26
Iron (Fe)	10	29	3.4
Manganese (Mn)	0.80	2.1	0.59
Calcium (Ca)	133	169	131
Magnesium (Mg)	31	47	36
Sodium (Na)	7.0	16	9.4
Potassium (K)	3.9	5.4	5.6
Bicarbonate (HCO_3)	512	784	542
Carbonate (CO_3)	0	0	--
Sulfate (SO_4)	70	1.6	45
Chloride (Cl)	2.0	3.8	3.4
Fluoride (F)	0.3	0.2	0.2
Nitrate (NO_3)	0.1	0.3	0.0
Dissolved Solids	452	690	530
Hardness (as $CaCO_3$)			
Ca, Mg	460	616	488
Noncarbonate	40	0	31
Specific Conductance (micromhos @ 25 C)	872	1070	854
pH	8.0	8.1	7.2
Color	--	--	5

(a) Well 2 Columbia Bottom (Emmett, 1974).
(b) Well 3 Columbia Bottom (Emmett, 1974).
(c) Median values - wells in Missouri River Valley alluvium between St. Charles and Jefferson City (Emmett and Jeffrey, 1968).

north-northeast winds at the Hall Street site than at the [illegible] difference will be slight since the river valley is [illegible]

Another valley effect, lower minimum temperatures [illegible] from cool air descending to the valley floor at night [illegible] by the heat produced by man's activities in the urban [illegible] This "heat island" effect is sufficient to lower the annual [illegible] days of freezing temperatures from 108 at the airport [illegible] 80's for the downtown area. The urban location also causes [illegible] of wind speeds as a consequence of the central city buildings [illegible] free flow of wind through the area.

The lowest mean wind speeds occur in the [illegible] is also the period with the greatest frequency of days [illegible] pollution potential. These days are characterized by low wind [illegible] rain, and temperatures increasing with height in the atmosphere [illegible] dispersion of air pollutants in the atmosphere is inhibited. In the St. Louis area, the frequency of high-air-pollution-potential days is relatively low compared with that in the eastern and far western portions of the U.S. However, with regard to air-pollution aspects of the [illegible] transfer facility, the frequency of high-air-pollution potential [illegible] not as important a climatological factor as the frequency of high [illegible] and days with precipitation. High winds would generate [illegible] dust, while precipitation would wet down the coal and wash out [illegible] the air.

A factor in the supression of dust is the frequency of [illegible] In the St. Louis area over the 10-year period from 195[illegible] annual number of days having 0.01 inch or more of precipitation [illegible] snow, hail, etc.) varied from 63 days in East St. Louis, Illinois, to 72 days near Alton, Illinois. During this same period, precipitation [illegible] 0.01 inch or more was measured at the Sr. Louis airport [illegible] 66 days during the year. However, this particular [illegible] ly dry one and the annual average over a longer period [illegible] approximately 111 days.

Normal annual precipitation (see Table 2-8) at the St. Louis airport is 35.3 inches (1931 to 1960), with recorded extremes of over 6[illegible] inches (1858) and about 21 inches (1953). December through February are the driest months, with monthly normals totalling about [illegible] inches. [illegible] through June are usually the wettest months with a normal total of about 12 inches for the 3 months. For the period covered by Table 2-8, the maximum in any one calendar month at the St. Louis airport was just over 9 inches in April, 1970; however, in August 1946, over [illegible] inches of precipitation was recorded elsewhere in the locality. (NOAA, [illegible]).

For the period covered by Table 2-8 the maximum 24-hour precipitation was 3.29 inches.

TABLE 2-8. PRECIPITATION - NORMALS, MEANS, EXTREMES - ST. LOUIS, MISSOURI, STATION

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Year
Precipitation[a], inches													
Monthly Normal[b]	1.98	2.04	3.08	3.71	3.73	4.29	3.30	3.02	2.76	2.86	2.57	1.97	35.31
Maximum Monthly[c]	3.61	4.12	5.54	9.09	7.25	8.65	7.81	6.44	6.21	5.77	5.74	6.50	9.09
Year	1969	1966	1963	1970	1961	1969	1958	1970	1972	1969	1968	1971	4/70
Minimum Monthly[c]	0.22	0.25	1.09	1.37	1.02	0.47	0.60	0.08	0.76	0.46	0.44	0.32	0.08
Year	1970	1963	1966	1959	1972	1959	1970	1971	1960	1965	1969	1958	8/71
Maximum in 24 Hr[c]	2.16	2.56	1.84	2.33	2.90	3.29	3.16	2.24	2.85	2.14	2.87	2.57	3.29
Year	1967	1959	1962	1970	1961	1960	1958	1970	1969	1969	1972	1971	6/60
Snow, Ice, Pellets, Mean Total[d]	4.2	3.8	4.4	0.3	tr	0.0	0.0	0.0	0.0	tr	1.2	2.9	16.8
Maximum Monthly[d]	13.2	12.9	22.3	6.5	tr	0.0	0.0	0.0	0.0	tr	11.3	11.1	22.3
Year	1962	1961	1960	1971	1944					1967+	1951	1939	3/60
Maximum in 24 Hr[d]	11.2	8.3	10.0	6.1	Tr	0.0	0.0	0.0	0.0	Tr	10.3	5.2	11.2
Year	1958	1966	1958	1971	1944					1967+	1951	1939	1/58

Data from NOAA (1972).
(a) Length of record, years, based on January data.
(b) Climatological standard normals 1931 to 1960.
(c) 15 years.
(d) 36 years.

2.1.6 AIR QUALITY

The Hall Street site is situated in an industrialized area of the Metropolitan St. Louis Air Quality Control Region (AQCR) in which total suspended particulate concentrations are in excess of the ambient standard. It was hoped that the standard would be met by mid-1975, but for this portion of the AQCR, attainment is going to take longer.

Nearest air quality station monitoring particulates is the City of St. Louis Station No. 3, located about 1-1/2 miles west of the proposed coal transfer facility site, near Interstate Highway I-70 and about 200 yards west of Shreve Avenue. Most recent annual particulate measurements available from this station are as follows:

Year	Annual Arithmetic Mean, micrograms/m^3	Annual Geometric Mean, micrograms/m^3
1972	126.0	111.4
1973	112.0	104.8
1974	122.2	111.8
1975	114.2	107.7

This station, while well located to measure highway effects on air quality, is poorly located to represent ambient air quality in the Hall Street area. Due to its location it characteristically receives excessively high chloride contents after a snow (when the roads have been salted).

There is a Regional Air Pollution Study (RAPS) station (No. 102) nearby, at Hall Street and Carrie Avenue. Unfortunately, the station is automobile pollution-oriented and determines such parameters as ozone, nitrogen oxides, etc., but does not determine particulates.

The immediate air quality goal in the St. Louis AQCR is to achieve the annual primary standard -- a geometric mean of 75 $\mu g/m^3$. Ultimately, it would be desirable to reduce the ambient concentration even lower so that the secondary standard, an annual geometric mean of 60 $\mu g/m^3$, is achieved.

During the past 4 years, the annual geometric mean for suspended particulates averaged over the 10 St. Louis City monitoring stations has decreased from 89.4 $\mu g/m^3$ to 80.1 $\mu g/m^3$. Thus, it can be expected that special effort will be expended to reduce particulate emissions in the areas where ambient concentrations are still in excess of standards. Furthermore, once the standards are achieved, these areas will be closely monitored to ensure that the standards are maintained. Consequently, any new source of particulates in the industrialized areas will be required to meet strict standards on the control of dust and other particulate emissions.

2.1.7 NOISE

The proposed site for the coal transfer terminal is located in a heaviiy industrialized area. It is bounded on the east by a railroad yard of the Burlington Northern R. R., and on the west by Hall Street, along which are numerous truck terminals, eleven between the northern boundary of the site and Prairie Avenue, the southern boundary of the site (see Plate 1). Between the diesel trucks going to and from the truck terminals and the diesel locomotives working in the railroad yard, the noise levels in the immediate area are not insignificant.

In one spot check at the Hall Street boundary of the site (July 30, 1975) the two principal noise sources were determined qualitatively to be primarily the heavy truck traffic along Hall Street, and, secondarily, the grain elevator to the southeast of the site. Railroad noise was observed intermittently.

2.2 BIOLOGICAL COMMUNITIES

2.2.1 AQUATIC COMMUNITIES

The aquatic communities present in the immediate vicinity of the proposed coal transfer facility are (1) the Mississippi River and (2) nonriver aquatic and semi-aquatic areas on the land side of the flood wall at the eastern boundary of the project site.

2.2.1.1 Mississippi River

The Mississippi River adjacent to the site is a portion of the Middle Mississippi River and as such has been studied extensively by the Corps of Engineers; the findings have been reported in the Draft Environmental Statement - Middle Mississippi River (Corps of Engineers, 1975). The reader is referred to that document for a thorough discussion of the existing habitat types, biotic components, and general environmental quality of that region of the Mississippi River between the Ohio and Missouri Rivers.

The coal transfer terminal is to be located approximately one mile upstream of the mouth of the Chain of Rocks Canal on the west bank of the main channel of the Mississippi River. The river at this point has no maintained channel although a natural channel exists. River traffic is almost exclusively limited to the Chain of Rocks Canal. Riverine habitats in this portion of the river include main channel, side channel, and slough habitats. The main channel differs slightly from

that described in the Middle Mississippi River Environmental Statement (Corps of Engineers, 1975) in that no artificially maintained navigation channel (400-foot wide and 9-foot deep) is present.

The composition of the riverine aquatic communities is controlled by physiochemical features such as depth, substrate conditions, temperature, current, turbidity, dissolved oxygen content, and other chemical and biological characteristics. In general, the turbidity and current results in reduced phytoplankton and rooted aquatic macrophytes in the main channel. These populations are much better developed in the side channel and slough areas where conditions favor them. Benthic organisms, likewise, are more abundant in lower velocity areas out of the main channel.

The fishes inhabiting the middle Mississippi River are well documented. An extensive literature review and research program carried out by various member agencies of the Upper Mississippi River Conservation Committee revealed a total of 82 fish species that were indigenous to the Middle Mississippi River (Smith, Lopinot, and Pflieger, 1971).

The principal game fishes likely in the area are the freshwater drum, channel catfish, crappies species, bluegill, warmouth, green sunfish, white bass, largemouth bass, blue catfish, flathead catfish, and bullhead species. The channel catfish is a preferred species because of its outstanding sporting qualities and excellent table values.

During the period 1945 to 1970, the stretch of the Mississippi River between Lock and Dam No. 25 and the confluence of the Ohio River contributed between 285,000 and 1,000,000 pounds per year to the total Mississippi River catch. In the late 1940's this area accounted for up to 25 percent of the total upper Mississippi River catch. However, in recent years it has contributed less than 10 percent to the total catch. The decrease in the percentage contribution to the total catch is not due to a decrease in catch in the area, but rather to an increase in catch in other pools. The catch of the river from Pool 26 southward in recent years has fluctuated widely, but a catch of approximately 500,000 pounds per year is about average. Drum, catfish, carp, and buffalo are the predominate commercial species.

2.2.1.2 Non-River Aquatic and Semi-Aquatic Areas

Within the area to be occupied by various facilities of the 45-acre coal transfer terminal are two small aquatic areas and one semi-aquatic area (Figure 2-10). These three areas, altogether occupying less than one acre, are apparently borrow pits from previous construction activities, probably railroad construction. Bottom conditions in the permanent water areas are not favorable to establishment of aquatic organisms; consisting of the cinders which have been utilized for bedding

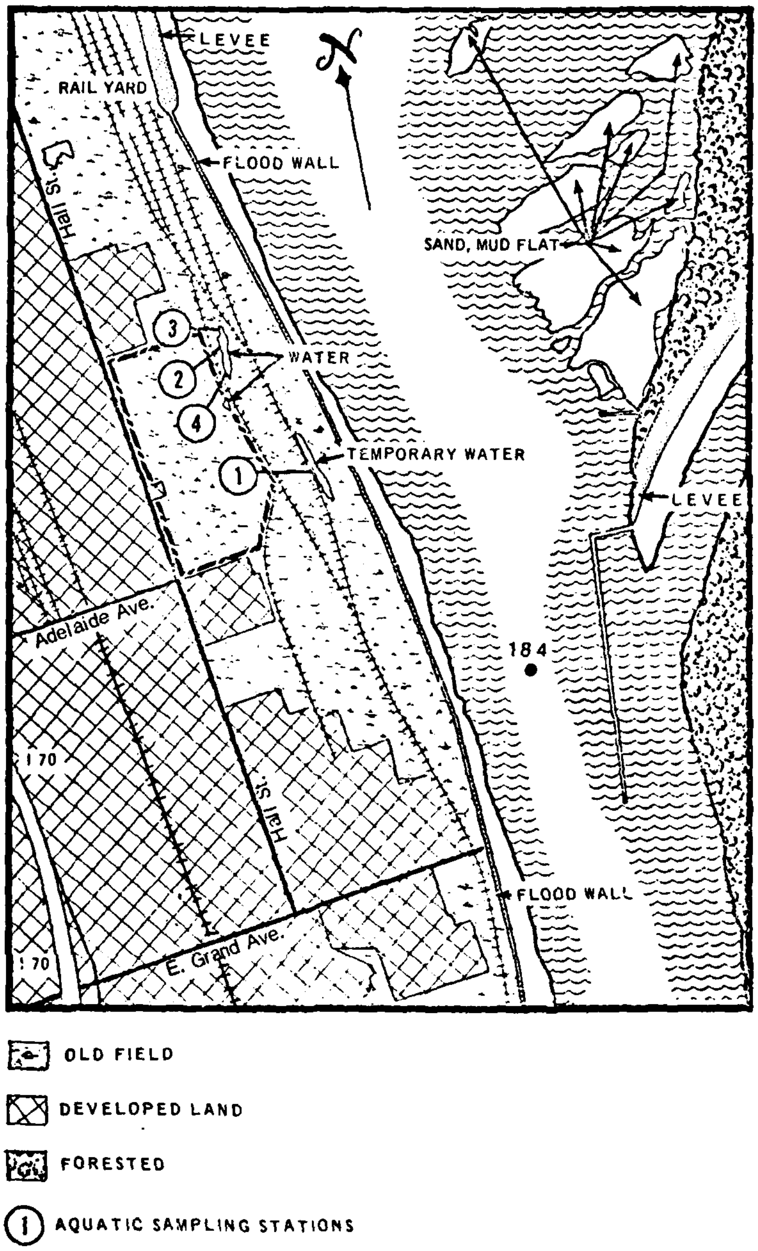


FIGURE 2-10. TERRESTRIAL HABITATS IN THE VICINITY OF THE COAL TRANSFER FACILITY SITE

material in the railyard and an organic ooze from decaying algae. No fishes were observed nor are they likely to be present. Several snails and tadpoles were observed, however (Table 2-9). A grab sample of benthos and macroinvertebrate organisms was made in order to characterize the nature of the aquatic biota of the small borrow pits (Table 2-9). The results, while not conclusive due to the single sample date, do indicate a lack of diversity of organisms from what could be expected in a pond-type environment in the St. Louis area. The small size, shallowness, unfavorable substrate, and likelihood of periodic runoff input from the surrounding railyards would account for this reduced diversity.

The semi-aquatic area is presently in cattails and had several inches of water in it at the time of sampling following several days of substantial rain (June, 1975). From indications at the area and from several previous airphotos, this area does remain dry during several periods in the year.

2.2.2 TERRESTRIAL COMMUNITIES

Due to the location of this 45-acre facility in the midst of railyards and truck terminals in downtown St. Louis, little natural habitat is available within the immediate vicinity. The coal transfer terminal site and some immediately adjacent areas do, however, provide cover and food for a variety of animal species and support a diversity of plant species. Discussion of habitat types will be divided into two groups: (1) those terrestrial communities between the flood wall and levees and the river on the unprotected floodplain, and (2) those terrestrial communities protected from river flooding by the flood wall or levees. Figure 2-10 is a map of the terrestrial habitats in the vicinity of the Hall Street Transfer Facility. Descriptions of the habitats follow.

2.2.2.1 Unprotected Floodplain Communities

The floodplain of concern here is that found outside the floodwall, along the riprapped riverbank. This is a narrow linear habitat comprised mainly of willow, sycamore, cottonwood, and other associated plant and animal species. This habitat occupies less than one acre adjacent to the docking area.

No unprotected floodplains are included in the coal terminal site proper or adjacent land; all of the western bank in the St. Louis area is protected.

TABLE 2-9. AQUATIC ORGANISMS OBSERVED IN BORROW PITS IN COAL TERMINAL AREA

Station	1	2	3	4[a]
Diptera				
Chironomidae - midges				
Procladius sp.	4		3	2
Pentaneura sp.	3		1	1
Pseudochironomus sp.			1	
Chironomus (*Cryptochironomus*) sp.				1
Unidentified pupa	1			
Culicidae				
Chaoborus sp.			1	
Ephemeroptera - mayflies				
Baetidae				
Centroptilum sp.	1			
Odonata - damselfly				
Coenagrionidae				
Isehnura sp.		2		
Coleoptera - Beetles (larvae)				
Haliplidae				
Peltodytes sp.				
Hydrophilidae				
Berosus sp.	2			
Hemiptera				
Corixidae - water boatmen				
sp.		4		
Veliidae - water striders				
Microvelia sp.		3		
Megaloptera - helgrammites				
Corydalidae				
Chavliodes sp.		1		1
Gastropoda - snails				
Physidae				
Physa sp.	X[b]	5		
Planorbidae				
Gyraulus sp.	X[b]			
Oligochaeta				
Tubificidae				
sp.				1
Ostracoda				
sp.			11	
Tadpole				1

(a) Station locations shown in Figure 2-10.

(b) Organisms dead prior to collection.

2.2.2.2 Protected Communities

The construction of flood walls and levees along the Mississippi River to protect human development and economics has led to large areas of previously annually flooded land being consistently flood protected. It is just such an area that will be occupied by the proposed coal transfer terminal. Terrestrial habitats occupying the land to be developed and adjacent areas include oldfields, railroad rights of way, and developed land. There are no forested areas and only isolated trees are present in this area.

Oldfield. Occupying the largest percentage, greater than 95 percent (~42.75 acres) of the 45 acres to be developed in this project, the oldfield habitat supports a productive plant community and a diverse animal community. Plant species are predominantly root perennials. Important species are thistles, Queen Anne's lace, teasels, curly dock, and ragweed (*Ambrosia* sp.).

Small mammals are common in this oldfield habitat. Typical species include cotton-tailed rabbits, mice, shrews, and voles. Larger mammals such as the raccoon, woodchuck, or long-tailed weasel might be anticipated.

Oldfield habitats of and adjacent to the site have been described above as being good producers of seeds, insects, and cover. Particularly in the oldfield and shrubby railroad rights-of way, the seed-eating birds are abundant.

Railroad Rights-of-Way. Inasmuch as rail lines surround and bisect the proposed terminal project area, the organisms occupying these rights-of-way will be separately discussed. The area occupied by the railroad rights-of-way is approximately two acres. The habitat is very similar to the oldfield communities, with some notable exceptions, and may be considered a subtype. It is in these areas that the shrubs and woody vines add an additional component to the habitat. Species include smartweeds, southern dewberry, trumpet creeper, poison ivy, and grape. Localized thickets of riverbank grape, white mulberry, and roughleaved dogwood are common along with isolated saplings of winged elm and silver maple.

The railroad rights-of-way provide habitat for similar kinds of animal populations as the oldfield. They provide several different food sources and the added protection of cover.

Developed Land. Included in this habitat are industrial structures and their environs which are greatly influenced by industrial development. While no such developed areas occur within the 45-acre site, such areas are found in the immediate vicinity of the coal transfer terminal, including grain elevator operations, truck terminals, rail yards, power transmission facilities, and assorted light manufacturing

and transportation activities.

No mammals depend primarily on developed land for habitat. The Norway rat and house mouse may be locally abundant, and feral dogs and cats may be transients. The American toad is attracted by insects found at night in lighted areas. Fencerows, shrubs, and piles of debris pr - vide shelter by day. Several species may occur at night, attracted t. food and reduced human activity, but seek shelter in other areas by day. These include the terrestrial salamanders, skunks, black rat snake, eastern hognose snake, and the king snake. Due to the proximity of the oldfield and right-of-way habitats, animals may be observed occasionally. An example would be the presence of rabbits in the tall grass and clover which often forms a lawn in front of administrative offices.

Bird species expected to utilize the developed land adjacent to the terminal include the house sparrow, starling, chimney swift, rock dove, and barn swallow.

2.2.3 THREATENED, RARE, AND ENDANGERED SPECIES

2.2.3.1 United States Lists

Information on the staus of fauna recognized nationally as threatened or endangered has been taken from two lists: (1) Threatened Wildlife of the United States (U.S. Department of Interior, 1973), and (2) United States List of Endangered Fauna (U.S. Department of the Interior, 1974). These lists include those biotic species which are either in danger of extinction (Endangered Species) or which are likely to become endangered within the foreseeable future (Threatened Species) throughout all or a significant portion of their range. A separate category, Status Undetermined, has been established for a number of species that have been suggested as possibly threatened with extinction, but for which information is presently insufficient to determine their status.

For those species which have been declared Endangered Species, protection has been established for the species and their habitat in accordance with the Endangered Species Act of 1973 (Public Law 93-205; 87 Stat. 884). Three species of fauna with this classification, the peregrine falcon, Southern bald eagle, and Indiana bat, occur within the Middle Mississippi River area and thus may occasionally occur near the terminal site. All three species are extremely uncommon across their ranges (Table 2-10). Their lack of tolerance of human activities would serve to virtually exclude them from the St. Louis metropolitan area.

Four species of fauna, the pallid sturgeon, Illinois chorus frog, wood ibis, and osprey, which have been categorized as Status Undetermined species, also occur within the reaches of the Middle Mississippi River but are unlikely to utilize areas similar to the project site.

TABLE 2-10. ENDANGERED AND THREATENED FAUNA OF THE MIDDLE MISSISSIPPI RIVER

Common Name	Scientific Name	Status[a]
Pallid Sturgeon	Scaphirhynchus albus (Forbes and Richardson)	SU
Illinois Chorus Frog	Pseudacris streckeri illinoensis Smith	SU
Wood Ibis or Wood Stork	Mycteria americana Linnaeus	SU
Osprey	Pandion halizetus carolinensis (Gmelin)	SU
Peregrine Falcon	Falco peregrinus anatum (Bonaparte)	E
Southern Bald Eagle	Haliaeetus leucocephalus (Linnaeus)	E
Indiana Bat	Myotis sodalis Miller and Allen	E

(a) The status of each species is indicated by the following symbols: SU - status undetermined, E - endangered.

2.2.3.2 State Lists

Information on the status of flora and fauna recognized by the state of Missouri as rare or endangered has been derived from the listing of "Rare and Endangered Species of Missouri" (Missouri Department of Conservation and Soil Conservation Service, 1974). The identification of rare and endangered plant species is presently limited to recognition on a state-by-state basis only. Due to the previous repeated disturbances and to the nature of the substrate of the 45-acre project site, it is unlikely that any of the rare or endangered plant species would be found there.

Knowledge of the status of rare and endangered invertebrates is very fragmentary. Missouri included a number of invertebrates on its list of rare and endangered species, but no attempt was made to assign a status to any species. None of the benthic organisms collected by Emge, et al. (1974) or Ragland (1974) in preparation of the Environmental Report for the Middle Mississippi River (Corps of Engineers, 1975), was included on Missouri's rare and endangered list. Also, no species considered rare and endangered by the American Malacological Union have been recorded from the Mississippi River (Stansbery, 1968).

2.3 CULTURAL ELEMENTS

2.3.1 AREA CHARACTERISTICS

The proposed site for the Hall Street rail to barge transfer terminal is located within the St. Louis Regional Area that includes the City and County of St. Louis; St. Charles, Franklin, and Jefferson Counties in Missouri, and Madison, St. Clair, and Monroe Counties in Illinois. The regional area comprises the St. Louis Standard Metropolitan Statistical Area (SMSA), plus Monroe County. Figure 2-11 shows the census tract map for the St. Louis regional area.

As established by the Bureau of the Census, the St. Louis Region had a population of 2.38 million people in 1970. By April, 1972, the region's population had increased to an estimated 2.45 million, an increase of 2.8 percent (East-West Gateway, 1974). As shown in Table 2-11, even though the regional population had increased by 2.8 percent between 1970 and 1972, the cities of St. Louis and East St. Louis experienced population losses.

Population projections for the years 1975 and 1990 are provided in Table 2-12.

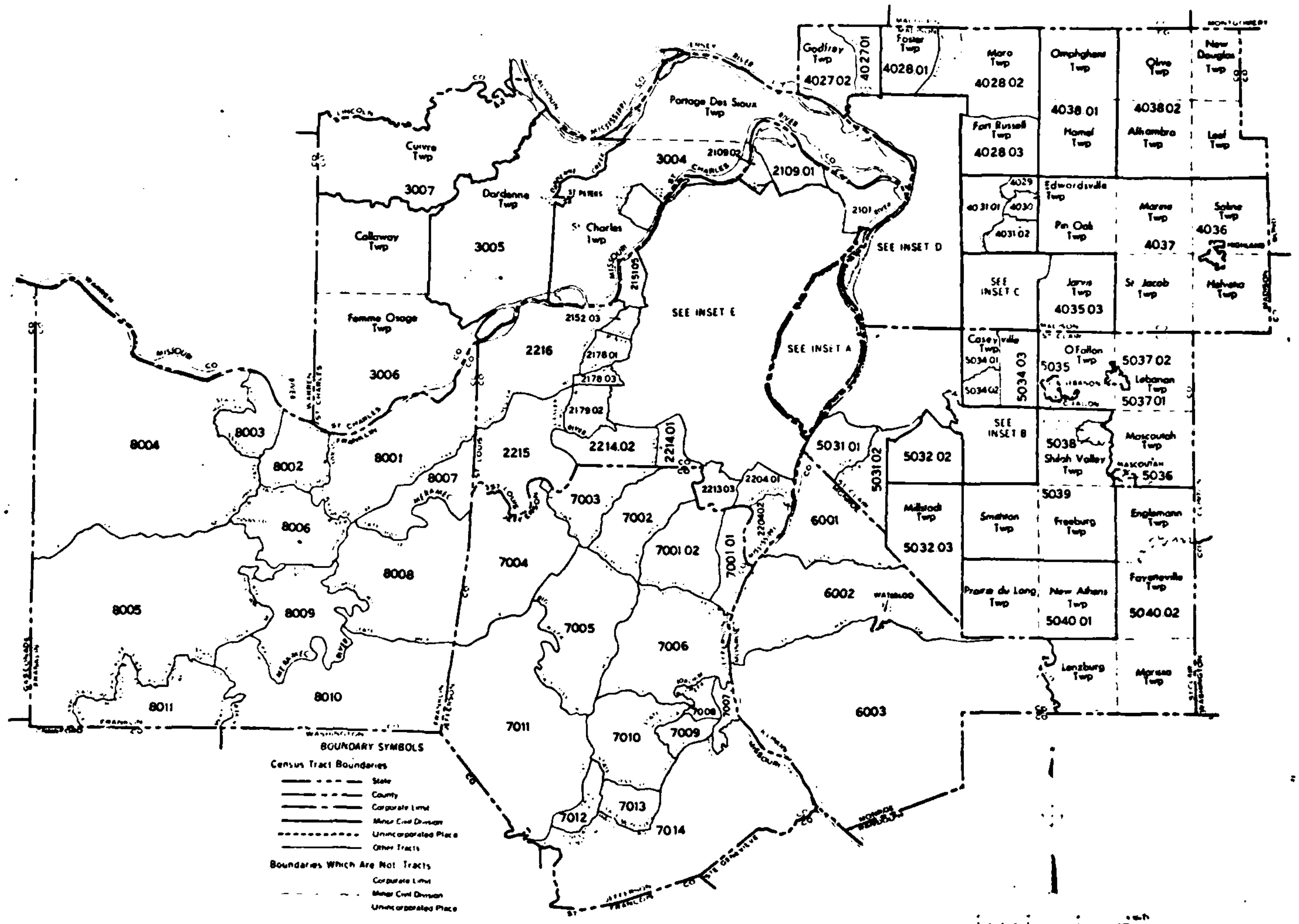


FIGURE 2-11. CENSUS TRACTS IN THE ST. LOUIS REGIONAL AREA

TABLE 2-11. ST. LOUIS REGIONAL POPULATION, 1970 and 1972

	1970	1972	Percent Change
City of St. Louis	622,236	577,000	-7.3
St. Louis County	951,353	1,038,000	+9.1
Jefferson County	105,248	109,000	+3.6
St. Charles County	92,954	102,000	+9.8
Franklin County	55,116	58,000	+5.2
Total Missouri Portion	1,826,907	1,884,000	+3.1
City of East St. Louis	69,996	68,600	-2.0
St. Clair County*	215,180	225,400	+4.7
Madison County	250,934	252,000	+ .4
Monroe County	18,831	19,500	+3.6
Total Illinois Portion	554,941	565,500	+1.9
Metropolitan Total	2,381,848	2,449,500	+2.8

Source: East-West Gateway Coordinating Council, Port-Development Task Force, Study of the Port of Metropolitan St. Louis, Phase One: Executive Summary, February 28, 1974.

* Not including the city of East St. Louis.

TABLE 2-12. ST. LOUIS STANDARD METROPOLITAN STATISTICAL AREA POPULATION PROJECTIONS (1975-1990)

Jurisdiction	1975	1980	1985	1990
Missouri				
St. Louis City	598,618	575,000	575,000	572,010
St. Louis County	1,052,510	1,153,962	1,232,780	1,317,508
St. Charles County	134,484	173,278	203,522	218,947
Jefferson County	153,530	195,195	222,667	225,177
Franklin County	62,584	70,700	79,300	87,672
Illinois				
Madison County	255,758	258,808	276,003	293,677
St. Clair County	285,901	278,129	292,113	307,387
Monroe County	18,612	22,863	27,254	31,679
EWGCC REGION	2,561,897	2,727,935	2,908,639	3,054,057

Source: East-West Gateway Coordinating Council, Port-Development Task Force, Study of the Port of Metropolitan St. Louis, Phase One: Executive Summary, February 28, 1974.

2.3.2 SOCIAL CHARACTERISTICS

The proposed coal transfer facility is located wholly within Census Tract 1092. The storage track for incoming loaded coal cars extends northward into Census Tract 1085, and the storage track for emptied cars extends southward into Census Tract 1095. The general location of these tracts is shown in Figure 2-12; selected census data for the three tracts are presented in Table 2-13.

Of the residents of these census tracts, most of the persons employed are craftsmen and operatives, and the majority of the industrial workers are employed in manufacturing within the City of St. Louis and St. Louis County. The majority of workers use private autos to commute to work. The median family income is below the average for the St. Louis SMSA. The percentage of families below the poverty level in the area is higher than that for the St. Louis SMSA. The median value of housing units within the project area is also below the average for the St. Louis SMSA.

2.3.3 ECONOMIC CHARACTERISTICS

2.3.3.1 Industrial Base and Employment

As shown in Table 2-14, manufacturing plays an important role in the St. Louis SMSA, employing one-third the region's labor force. In 1967, manufacturing employment was 295,500 persons and supported a payroll of $2.2 billion and contributed value added of $4.1 billion to the economy. However, while manufacturing still holds its dominant position in providing employment to the region, the level of employment showed a decline by 1972. In 1972, manufacturing employment for the St. Louis SMSA stood at 256,600 persons (a loss of 38,900 employees or 13 percent since 1967), supporting a payroll of $2.6 billion and contributing value added of $5.1 billion to the economy.

Total SMSA employment decreased by 2 percent, from 889,000 to 881,000 between 1970 and 1972, although by August, 1973, this had grown again to 953,000.* While employment percentage in the St. Louis SMSA compared equally with that of the nation as a whole before 1967, it has been trailing behind the nation since that year.

The unemployment rate has been increasing faster than in other metropolitan areas like Kansas City and Memphis. In 1968, the unemployment rate for St. Louis SMSA was 3.6 percent as compared with 2.9 percent

* Source: East-West Gateway Coordinating Council, Study of the Port of Metropolitan St. Louis, Phase One, February, 1974.

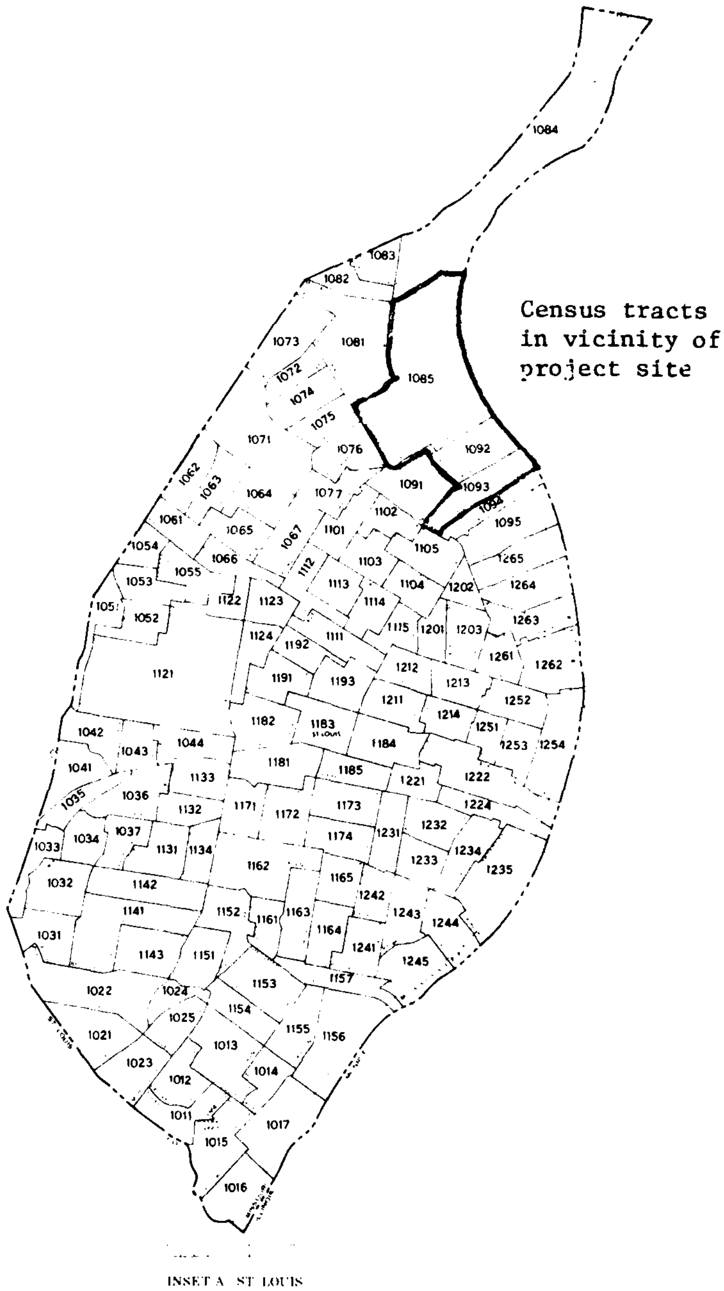


FIGURE 2-12. CENSUS TRACTS WITHIN THE CITY OF ST. LOUIS

TABLE 2-13. SELECTED ECONOMIC CHARACTERISTICS

	St. Louis SMSA	Project Area		
		Census Tracts		
		1085	1092	1093
Population	2,363,017	1,778	401	3,910
Families	593,927	311	103	966
School Enrollment	702,638	208	78	1,089
Median School Year Completed by Persons 25 Years and Older	11.7	8.7	8.6	8.7
Means of Transportation to Work				
Private Auto - Driver	614,814	286	86	590
Passenger	122,510	74	11	341
Bus or Streetcar	65,833	39	17	294
Subway or Rail	245	-	-	-
Walk to Work	42,459	82	23	101
Work at Home	18,836	-	-	28
Other	18,503	6	-	36
Place of Work				
St. Louis Central Business District	31,977	23	-	80
Rest of St. Louis City	307,941	351	69	947
University City, Mo.	8,822	-	-	29
Rest of St. Louis County	277,455	63	30	165
East of St. Louis, Ill.	19,312	-	-	-
Rest of St. Clair City, Ill.	50,989	7	-	14
Madison County, Ill.	66,002	-	-	6
Jefferson County, Mo.	13,649	-	-	-
St. Charles County, Mo.	18,389	-	-	6
Franklin County, Mo.	14,378	-	-	-
Outside SMSA	12,239	-	-	9
Male Labor Force	587,748	338	108	887
Female Labor Force	365,166	231	29	718
Occupation Employment				
Professional	136,241	46	-	66
Nonfamily Managers	69,599	9	-	19
Sales Workers	67,307	10	-	101
Clerical	182,445	120	13	206
Craftsmen	126,128	60	26	184
Operatives	118,447	125	38	356
Transport	36,346	35	17	70
Laborers	38,832	30	13	110
Farm Workers	7,218	-	-	11
Service Workers	104,059	92	26	292
Private Household	11,415	-	-	8
Industry Employment				
Construction	44,796	14	12	47
Manufacturing	258,869	213	47	481
Transportation	42,086	46	9	55
Communication and Utilities	28,008	22	5	35
Wholesale Trade	48,377	10	8	56
Retail Trade	141,927	62	13	277
Finance, Insurance, and Real Estate	46,149	18	-	46
Business and Repair Service	25,836	13	-	22
Personal Service	37,950	23	5	34
Health Service	51,194	36	9	131
Education Service	65,501	14	-	23
Other Service	37,253	5	4	83
Public Administration	50,329	42	21	82
Median Family Income, 1969, $	10,504	9,068	7,000	7,100
Families Below Poverty Level	48,010	16	19	154
Percent of All Families	8.1	5.0	20.2	16.3
Occupied Housing Units	736,116	517	144	1,385
Median Value of Housing Units, $	16,300	10,100	6,100	8,800

TABLE 2-14. MANUFACTURING EMPLOYMENT, PAYROLL AND VALUE ADDED, 1972

Manufacturing	Number of Employees (1000)	Payroll ($ Millions)	Value Added ($ Millions)
Food and Kindred Products	18.2	198.2	570.7
Miscellaneous Textile Goods	.5	3.1	4.5
Apparel, Other Textile Products	10.3	57.3	108.5
Lumber and Wood Products	2.5	18.4	32.1
Miscellaneous Wood Products	.5	3.4	7.3
Furniture and Fixtures	3.7	29.1	58.1
Paper and Allied Products	6.3	56.8	111.9
Printing and Publishing	14.9	151.5	283.2
Chemicals and Allied Products	16.4	159.6	489.2
Petroleum and Coal Products	3.1	38.4	150.7
Rubber, Misc. Plastics Products	3.9	30.4	64.4
Leather and Leather Products	5.2	27.1	47.4
Stone, Clay, Glass Products	8.2	79.0	161.1
Primary Metal Industries	21.7	221.0	443.9
Fabricated Metal Products	22.6	218.3	401.5
Ordnance and Accessories, NEC	3.5	31.4	66.6
Machinery, Except Electrical	20.4	197.2	359.6
Electric, Electronic Equipment	14.5	123.3	247.1
Transportation Equipment	55.4	663.2	1,513.8
Instruments, Related Products	2.7	24.4	52.7
Misc. Manufacturing Industries	4.0	27.3	58.9
Total	256.4	2608.0	5,190.0

Source: U.S. Department of Commerce, Bureau of the Census, Census of Manufacturers, 1972.

for the median of 21 selected labor markets. By 1972, this rate had increased to 6 percent for St. Louis SMSA while for the 21 regions, it had only climbed to 4.7 percent. Within the St. Louis SMSA, the City and County of St. Louis have been having the highest unemployment rate. (East-West Gateway Coordinating Council, 1974).

2.3.3.2 Land Use

The proposed site of the project can be characterized as urban industrial (see Plate 1). No residential housing is located within the project site or in the immediate vicinity. A truck terminal is located on Hall Street just north of the project site; another is located adjacent to the site on Hall Street just to the south. South of this truck terminal is a petroleum products bulk plant and a bulk sugar storage and handling facility. The west side of Hall Street, across the street from the site, is lined with truck terminals. The site is bounded on the east by the Burlington Northern Railroad yards. Southeast of the site, situated along the river, is a grain terminal also served by barges. East of the Burlington Northern yards is the flood wall protecting this industrial area from the Mississippi River.

The site of the proposed project, which is entirely within the limits of the City of St. Louis, is designated strictly for industrial development, thus barring land use for residential purposes. The site itself currently lies fallow.

The 70-acre tract of land on which the 45-acre project site is located will be owned by ACBL Western, Inc. The City of St. Louis has been granted a 10-year no-cost option to purchase the southernmost 25 acres of the property (see Plate 1).

Land for the coal dumper, car positioner, thawing facilities, and the ancillary railroad track will be leased from the Burlington Northern Railroad. The shoreline serving the dock and barge loader area will be leased from the City of St. Louis. ACBL Western, Inc. will hold easement rights from the Burlington Northern and City of St. Louis for an elevated conveyor for transporting coal from the storage piles across the railroad yard and the flood wall to the barge-loading facility.

2.3.3.3 Commercial Navigation

St. Louis is located at a strategic point on the inland waterways by which can be served 29 major industrial centers of the United States with a total population of 90 million people, or over half the nation's urban population. The port of St. Louis is open the year round and is considered the beginning of low-cost navigation to the Lower Mississippi and the Gulf Coast. (There are no locks below St. Louis.)

Additionally, 35 percent of the nation's economic activity is within 500 miles of St. Louis. The port of Metropolitan St. Louis is defined as the 70 miles of river frontage between river mile 138.8 and river mile 208.8 which also includes Lock No. 27 and Locks and Dam No. 26.

The port provides various facilities and services, among which are 74 docks. In 1973, 5 of these docks were public and 69 were private, providing services that include fleeting, ship building, and equipment repair and support services of marine insurance and banking, etc. The port is serviced by a rail interface of 14 line-haul rail carriers and numerous truck services.

The reported capacity of the port's handling equipment is 28 million tons per year; actual usage is 20 million tons, thus indicating port operation at about 70 percent of capacity. The port also has a storage capacity of 1.1 million tons for liquid commodities and 430,000 tons for dry bulk commodity.

Table 2-15 indicates commodities and tonnage of waterborne traffic handled by the Port of Metropolitan St. Louis in 1972. Commodities and tonnages of waterborne traffic handled at Lock No. 27 are summarized in Table 2-16. Lock No. 27 is located in the Chain of Rocks Canal, east of Mosenthein and Cabaret Islands. The proposed coal terminal facility is located on the west bank of the Mississippi River, just north of the outlet of the canal, and thus is in a very little-travelled portion of the river since the through traffic passes through the canal.

Dam 27 is located at river mile 190.3 in the river channel west of the Chain of Rocks canal. Barge traffic now using the lower reach of this channel below Dam 27 is derived from the operations of the Missouri Portland Cement Company and the St. Louis Grain Corporation.

Of the total traffic handled by the Port of Metropolitan St. Louis in 1972, fuel, coal, cash grains, and chemicals account for 82 percent of the total tonnage (35, 30, 10, and 7 percent, respectively, of total shipments). Outbound shipments are nearly twice as large as inbound, indicating the exportation of commodities from the region by water. Table 2-17 presents a breakdown of tonnage moving in the 195-mile reach between the mouths of the Ohio and Missouri Rivers by commodity-type and origin/direction/destination categories.

2.3.4 ARCHEOLOGY AND HISTORIC SITES*

Although the area of the proposed project has been heavily impacted by extensive and intensive urbanization over the course of

* Archeological investigation by Sidney Denny, Southern Illinois University.

TABLE 2-15. DOMESTIC WATERBORNE TRAFFIC HANDLED IN PORT OF METROPOLITAN ST. LOUIS, 1972[a]

Commodity	Thousands of Tons			Percent
	Receipts	Shipments	Total	of Total
Fuels and Lubricants	2,396	4,918	7,314	35.3%
Coal	1,657	4,469	6,126	29.6
Cash Grains	598	1,589	2,187	10.5
Chemicals	802	633	1,435	6.9
Primary Iron and Steel	749	174	923	4.4
Durable Manufactures	207	715	922	4.4
Grain Mill Products	6	728	734	3.5
Mining Products	566	9	575	2.8
Raw and Refined Sugar	146	-	146	.7
Fabricated Metal Products	101	26	127	.6
Crude Oil and Natural Gas	79	-	79	.3
Nondurable Manufactures	6	65	71	.3
Nonferrous Primary Metal	39	29	68	.3
Paper	31	-	31	.2
Metal Ores	13	-	13	.1
Iron Ore	9	-	9	.1
Lumber	2	-	2	-
Agricultural Goods	-	-	-	-
Canned Fruits and Vegetables	-	-	-	-
Total	7,407	13,355	20,762	100.0%

Source: East-West Gateway Coordinating Council, Study of the Port of Metropolitan St. Louis, Phase One, February 28, 1974.

(a) Port definition is from river mile 138.8 to 208.8.

TABLE 2-16. TOTAL TONS OF SHIPMENT THROUGH LOCK NUMBER 27, 1972

Commodity	Tons*	Percent
Grain	24,889,200	43.9
Coal	7,711,114	13.6
Petroleum Products	8,949,472	15.8
Chemicals	4,884,228	8.6
Sulfur and Misc.	7,709,059	13.6
Cement Sand-Gravel	1,006,420	1.8
Iron and Steel	1,545,655	2.7
Total	56,695,148	100.0

Source: U.S. Army Engineer District, St. Louis, Missouri, Lockmaster Records, 1973.

* The Lockmaster Records are usually higher than the exact amounts reported in the Waterborne commerce of the United States statistics. However, past trends have shown that the difference is 5 percent higher than the actual.

TABLE 2-17. INTERNAL COMMODITY TONNAGE BY COMMODITY AND DIRECTION, MOUTH OF MISSOURI TO MOUTH OF OHIO, 1972

Commodity	Total	Upbound	Inbound Upbound	Outbound Upbound	Through Upbound	Downbound	Inbound Downbound	Outbound Downbound	Through Downbound
Grain	24,958,048	--	--	4,515	3,255	1,427	492,680	1,707,158	22,749,013
Coal	11,752,901	1,286,678	370,108	5,743,842	2,206,808	19,195	--	2,123,602	2,668
Petro	10,296,338	24,293	1,853,360	921,138	4,860,438	118,826	656,695	303,401	1,558,237
CSS6	2,711,019	781,050	--	232,786	9,550	211,725	211,566	665,567	598,775
I & S	2,259,335	--	278,366	32,843	799,607	--	171,726	94,410	882,383
Ind. Chem.	4,413,366	--	505,603	226,239	3,121,935	4,800	87,924	154,099	312,766
Ag. Chem.	3,073,159	--	268,576	158,895	2,541,399	--	1,467	8,291	94,531
Misc. & Other	7,740,336	642,808	564,076	515,173	3,155,695	110,650	114,871	946,628	1,690,435
Total	67,204,552	2,734,829	3,840,089	7,835,431	16,698,687	466,623	1,736,929	6,003,156	27,888,808

(From C of E, 1975)

nearly two centuries, significant archeological resources could still be extant within the project area. The greatest potential for archeological resources results from the fact that the project area is located within three miles of the long-destroyed St. Louis Mound Group from which the city takes the name "Mound City" (Figure 2-13). The St. Louis Mound Group was a major sociopolitical outlier of the Cahokia Site and along with the Illinois mound groups at Mitchell, Pulcher, East St. Louis, and Lebanon, formed the second level of the complex political, religious and economic structure which make Cahokia the largest, most complex prehistoric cultural unit in the United States between 900-1500 A.D.

Because of the distance between the old mound group location and the project area it was felt that extensive habitation related to the mound group itself would not be found. However, such a possibility had to be explored. In addition, since the Mississippi River played such a significant role in the prehistoric occupancy of the St. Louis area throughout the chronological sequence, the possibility of other sites within the project area did exist and needed to be fully explored.

2.3.4.1 Field Procedures

Initial investigations on foot in the project area and discussions with STS Engineering, Inc. indicated that the entire project area had been extensively disturbed and a considerable amount of fill had been dumped in the area. Since under such circumstances a standard foot survey would have been useless, a program of sampling was worked out with STS Engineering. This program involved checking solid cores extruded from Shelby tube samples collected by STS and the checking of a series of back-hoe trenches excavated through the fill by STS personnel.

The boring logs supplied by STS indicate that the entire area is covered by a loosely compacted fill consisting of cinders, glass, metal, brick, and other modern debris to a depth ranging from 11.5 to 18 feet. Underneath these fills gray clays with some traces of organic matter were encountered.

A check of the Shelby tube samples from the less extensively disturbed areas nearer the river indicated the same general stratigraphy. None of the Shelby tubes examined at the STS labs yielded any prehistoric cultural material.

Examination of one of the back-hoe excavations likewise failed to indicate any prehistoric material. The excavation consisted of an 8-foot by 4-foot trench which was carried to a depth of approximately 15 feet. The modern fill material was very loosely compacted and consisted of an incredible array of modern junk including brick, cinders, glass, wood, metal, shoes, and other assorted historic material. The

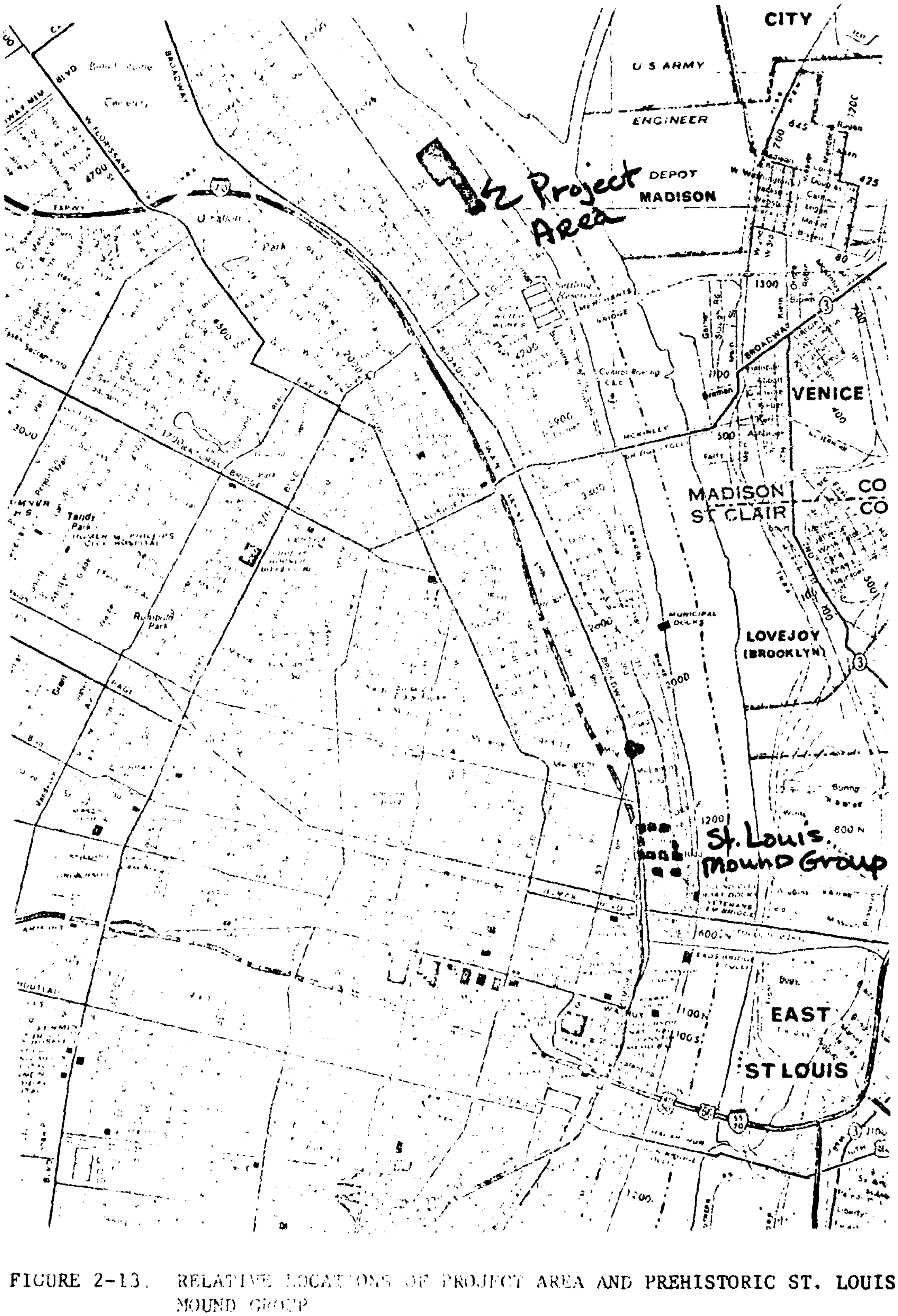


FIGURE 2-13. RELATIVE LOCATIONS OF PROJECT AREA AND PREHISTORIC ST. LOUIS MOUND GROUP

undisturbed soils were devoid of prehistoric material.

No evidence of any prehistoric occupation could be found in the area and from an archeological perspective the proposed project would have no discernible impact.

No historic sites listed in the National Register of Historic Places are on or near the project area.

3. RELATIONSHIP OF THE PROPOSED ACTION TO LAND USE PLAN

As discussed in the previous chapter, the site for the proposed coal terminal and facilities is within the area designated for industrial development by the city land use plan (See Figure 3-1). As indicated by this figure, virtually the entire area within St. Louis bordering the river is already zoned industrial; much of it is also proposed for industrial parks or similar use. Thus, from the point of view of land use, the construction and operation of the facility would enhance the achievement of the intended objectives of land use in the designated area--industrial development. If the land is not so utilized, the goal of the city's development plan is to secure another comparable use for the area.

The Economic Development Organization for the City of St. Louis, which incorporates the City Planning Commission, does not see any potential areas of incompatability or conflict with the objectives and specific terms of existing or proposed land use plans, policies, controls, if any, that have been formulated for the project area.

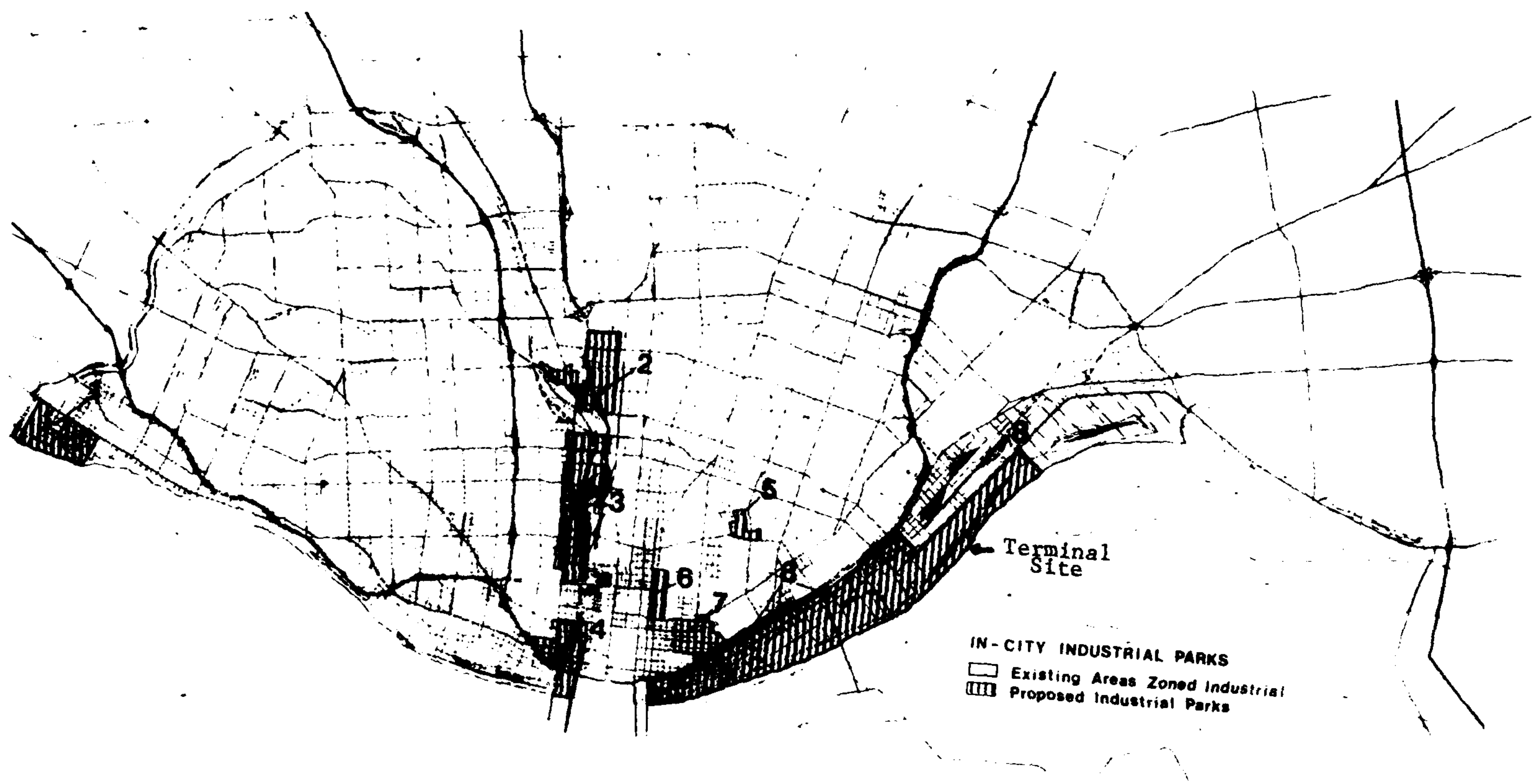


FIGURE 3-1. EXISTING INDUSTRIALLY ZONED AREAS AND PROPOSED INDUSTRIAL PARKS

4. PROBABLE IMPACT OF THE PROPOSED ACTION ON THE ENVIRONMENT

4.1 PHYSICAL ENVIRONMENT

4.1.1 PHYSIOGRAPHY AND GEOLOGY

The probable impact of the proposed action on the local physiography and geology is assessed as generally neglibible. As indicated in the description of the project, the site excavations, not extensive to begin with, will take place primarily in rubble fill. The sheet pile dock cells, driven to bedrock, will not have any measurable influence. The geological impact of extracting the 28,000 cubic yards of fill for the dock cells will have negligible impact, whether obtained from a terrestrial gravel pit, or dredged from some gravel bar in the river.

The physiography of the site will be essentially unchanged. The existing drainage pattern will be inconsequentially modified, so that erosion will be no more pronounced than the present trivial loss.

There will be no interactions with the existing flood wall which might affect its integrity, since no excavations are contemplated in the vicinity of the wall. A minimum distance of 40 feet from the wall will be maintained for all excavations and structures.

The construction and operation of the terminal may be regarded as in part contributing to induced changes in the western mining area from which the coal originates. These secondary impacts, which include other effects than physiographic and geologic, are discussed in a later section.

4.1.2 ELEMENTS OF THE MISSISSIPPI RIVER SYSTEM

The loading dock area will be located just below Sawyer Bend, on the outside radius of a substantial curve in the river. As indicated by recent coring samples taken in the dock area, only a very thin layer of sediments was found to overlie the bedrock, indicating that this is not an accretion zone. Thus, it is anticipated that once the random rock is removed from the area it presently occupies, the desired river depth in the dock area can be maintained, without a need for maintenance dredging. The river current will contribute to this, as will the propeller wash from the several daily tow boats serving the coal barges.

This depth maintenance is expected to occur, assuming the present configuration of regulating works (i.e., Phase I of the Mosenthein Island diversion). The construction of Phase II (additional diversion of flow to the main stem plus dikes along the west bank of Mosenthein Island to narrow the channel and divert the flow toward the west bank) will further reduce the possibility that